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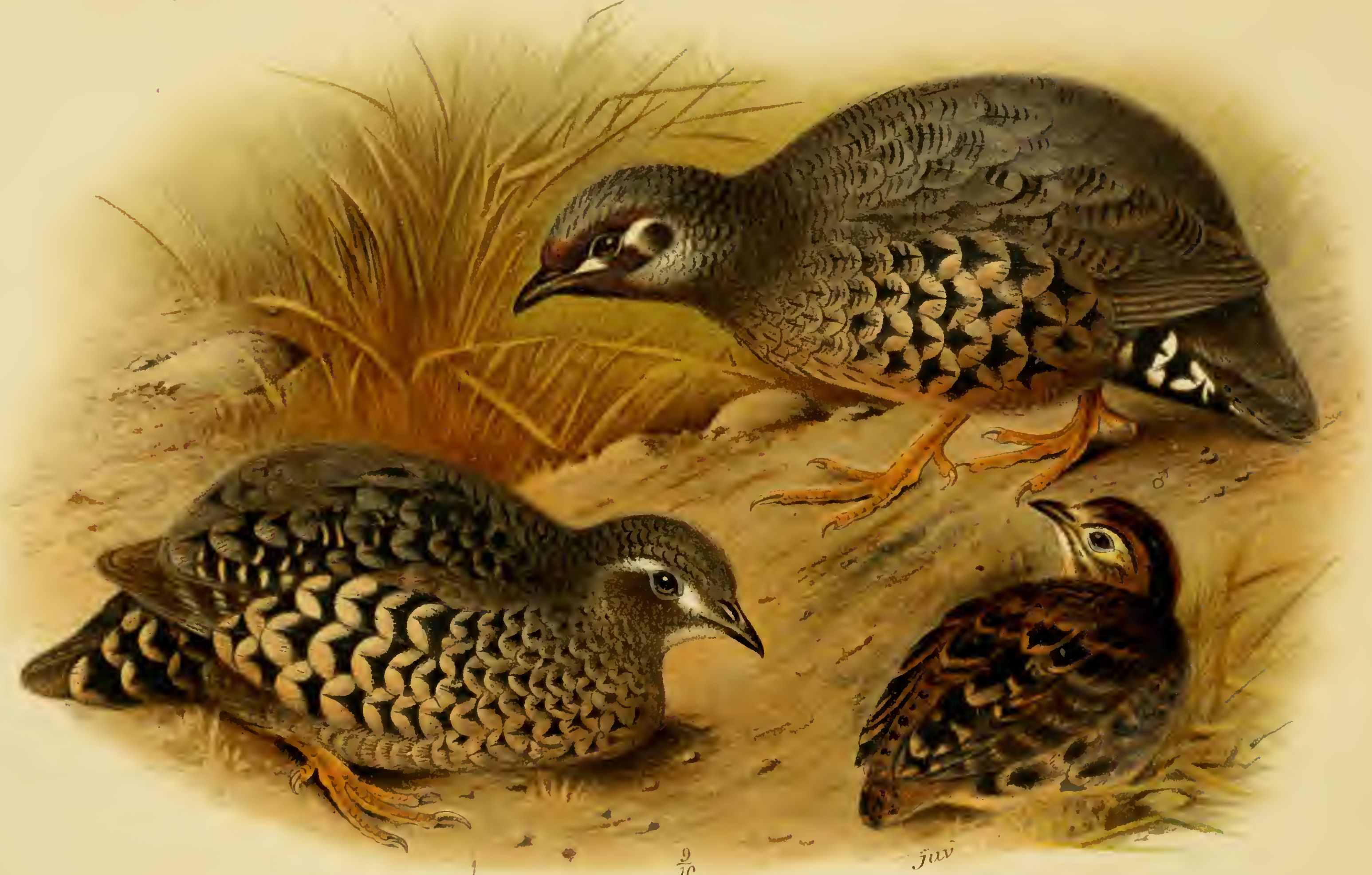
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CONTENTS OF VOLUME XIX.

No. 1.

PAGE

ON A NEW SPECIES OF BUSH-QUAIL (*Microperdix*) FROM GOALPARA, ASSAM. (*With a Plate*). By W. R. Ogilvie-Grant. WITH FIELD NOTES by C. M. Inglis 1

THE KATHIAWAR LION. By Lieut.-Col. L. L. Fenton 4

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN HILL STATIONS OF THE BOMBAY PRESIDENCY). (*With Plates E & III*). By T. R. Bell, I.F.S. 16

PLANTS OF THE PUNJAB. A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR. Part II. By Lieut.-Col. C. J. Bamber, F.L.S., I.M.S. (*Continued from page 861 of Volume XVIII*). 59

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part IX. *Lycodon aulicus* and *Lycodon striatus*. By Major F. Wall, I.M.S., C.M.Z.S. (*With Plate IX* and Diagram 1.) (*Continued from page 735 of Volume XVIII*) 87

A LIST OF THE BIRDS OF THE BHAMO DISTRICT, UPPER BURMA. By Major H. H. Harington (92nd Punjabis) 107

ON SOME UNDESCRIBED BEES AND WASPS, CAPTURED BY LIEUT.-COL. C. G. NURSE IN INDIA. By P. Cameron 129

THE ORCHIDS OF THE BOMBAY PRESIDENCY. Part VIII. (*With Plate VIII*). By G. A. Gammie, F.L.S. (*Continued from page 834 of Volume XVIII*) 139

BIRD NOTES FROM MURREE AND THE GALIS. By Major H. A. F. Magrath 142

ON THE FLORA OF CUTCH. Part II. By E. Blatter, S.J. (*Continued from page 777 of Volume XVIII*) 157

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, No. 2. (*With Plate B.*) By J. C. Kershaw and G. W. Kirkaldy 177

LIST OF FERNS FOUND AT AND AROUND MUSSOORIE, 1908. By James Martin 179

52092

PAGE

MEASUREMENTS OF SOME OF THE HORNS IN THE COLLECTION OF THE BOMBAY NATURAL HISTORY SOCIETY. By N. B. Kinnear 184

REVIEW.—VENOMS, VENOMOUS ANIMALS AND ANTI-VENOMOUS SERUM THERAPEUTICS.) By A. Calmette, M.D................ 210

OBITUARY.—Lieut.-Col. C. T. Bingham 214

ON THE EXISTING "CLOSE TIME" FOR BIRDS AND ANIMALS IN THE BOMBAY PRESIDENCY. By J. E. C. Jukes, I.C.S. 216

CORRESPONDENCE.—"The Protection and Preservation of Game in India." 220

A List of the Publications relating to the Oriental Region. From The "Zoological Record," 1906 225

MISCELLANEOUS NOTES.—

1.—Tigers and their Prey. By L. V. Bagshawe 253

2.—Malayan variety of the Sambhur (*Cervus unicolor*). (*With a photo*). By H. S. Davies 253

3.—Wild Pigs' Lairs in the Rains. By H. R. Blanford ... 254

4.—Habitat of Chinese Pangolin (*Manis aurita*). (*With a map*). By F. E. W. Venning 254

5.—The Jungle Crow (*Corvus macrorhynchus*). By Major H. A. F. Magrath 256

6.—Nesting of the Long-Tailed Grass-Warbler (*Laticilla burnesi*) in the Punjab. By A. J. Currie 258

7.—Note on the Slaty-Blue Flycatcher (*Cyornis leucomelanurus*) and the Common Ruby-Throat (*Calliope camtschatkensis*) in Tirhut. By Charles M. Inglis ... 259

8.—The Rufous-Backed Sparrow (*Passer pyrrhonatus*) nesting in the Punjab. By A. J. Currie 259

9.—The Black-capped Kingfisher (*Halcyon pileata*) in the Thana District. By L. H. Savile 260

10.—Note on the Chinese Crimson Horned Pheasant (*Tragopan temmincki*). By Eugene W. Oates 260

PAGE

11.—Sarus Crane (*Grus antigone*) in Salsette. By Heugh S. Symons 261

12.—Occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) in the Konkan, Western India. By Heugh S. Symons 261

13.—Occurrence of the Spoonbill (*Platalea leucordia*) in Lower Burma. By J. C. Hopwood 261

14.—Occurrence of the Peewit (*Vanellus vulgaris*) in Tirhut. By Charles M. Inglis 262

15.—The Lesser Flamingo (*Phœnicoptera minor*) in Cutch. By Rao Khengarji 262

16.—The Whooper Swan—A Correction. By Lieut.-General W. Osborn, I. A. 262

17.—The White-winged Wood-Duck (*Asarcornis scutulata*) in Tenasserim. By K. Macdonald 263

18.—The Cotton-Teal (*Nettapus coromandelianus*) in Sind. By R. E. Gibson, I.C.S. 263

19.—The Cotton-Teal (*Nettapus coromandelianus*) in the Konkan, Western India. By Capt. B. Bacon........ 264

20.—Occurrence of the Pink-Headed Duck (*Rhodonessa caryophyllacea*) in Burma. By E. R. Jardine 264

21.—The Stiff-tailed Duck (*Erismatura leucocephala*) near Nowshera. By Lt. W. P. C. Tenison, R.A. 264

22.—Cruelty to Wild-Fowl in the Punjab. By Major H. A. F. Magrath 265

23.—Local Bird Migration. By A. J. Currie. 265

24.—A new colour variety of Macclelland's Coral Snake (*Callophis macclellandi*) and extension of the habitat of this species. By Major F. Wall, I.M.S., C.M.Z.S. ... 266

25.—Notes on two casualties from the Sawscaled Viper (*Echis carinata*). By Major F. Wall, I.M.S., C.M.Z.S.. 266

26.—Remarks on Snake Notes in the last Journal (No. 4, Vol. XVIII). By Major F. Wall, I.M.S., C.M.Z.S. ... 267

PAGE

27.—A Correction—The Butterflies *Pieris brassicæ* and *canidia*. By Capt. H. D. Peile, I.M.S. 269

28.—On *Teracolus* (*Colotis*) *fausta* and other species of the Genus. By K. Bernhardt 270

29. Description of a new species of *Charaxes* from the Bhutan Frontier. By. G. W. V. de Rhé-Philipe ... 270

30.—Migration of Butterflies. By H. L. Andrewes........... 271

31.—Sexual attraction in Lepidoptera, By G. P. Millett ... 272

32.—Peach leaves as a substitute for Laurel leaves. By H. L. Andrewes 273

33.—Do Animals die a Natural Death? By Lieut.-Col. G. H. Evans, F.L.S. 273

34.—The fear of man in Wild Animals. By Major R. G. Burton (94th Russell's Infantry) 276

PROCEEDINGS OF THE BOMBAY NATURAL HISTORY SOCIETY ... 280

No. 2.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part X.—THE BRIDAL SNAKE (*Dryocalamus nympha*). (*With plate X and Diagram I.*) By Major F. Wall, I.M.S., C.M.Z.S. 287

A LIST OF THE BIRDS OF THE BHAMO DISTRICT, UPPER BURMA. Part II. By Major H. H. Harington (92nd Punjabis)...... 299

THE FLORA OF PANCHGANI. (*With a Map.*) By E. Blatter, S.J. 314

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, No. 3. (*With Plates C. and I.*) By J. C. W. Kershaw and G. W. Kirkaldy 333

NOTES ON SNAKES FROM THE NEIGHBOURHOOD OF DARJEELING. (*With a Plate.*) By Major F. Wall, I.M.S., C.M.Z.S. 337

SOME RANGOON BIRDS. By Major H. H. Harington (92nd Punjabis) 358

THE NESTING OF THE BAR-HEADED GOOSE (*Anser indicus*) IN TIBET. (*With Plate A.*) By F. M. Bailey 367

PAGE

PLANTS OF THE PUNJAB. Part III. By Lieut.-Col. C. J. Bamber, F.L.S., I.M.S. 370

SOME NATURE NOTES. By Lieut.-Col. R. G. Burton, 94th Russell's Infantry 399

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA. IX. By E. Meyrick, B.A., F.R.S., F.Z.S. 410

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. (*With Plates F. and I.*) By T. R. Bell, I.F.S. 438

PLANTS GATHERED IN AND ABOUT MUSSOORIE DURING 1908. By James Marten 475

THE PRESERVATION OF NATURAL HISTORY SPECIMENS IN AIR-TIGHT CASES. By John Wallace, C.E. 502

NEW AND LITTLE KNOWN INDIAN HYMENOPTERA. By Lieut.-Col. C. G. Nurse 510

MISCELLANEOUS NOTES.—

1.—A tailless Jackal. By Lt.-Col. R. M. Betham 518

2.—A fight between a Hyæna and a Panther. By Capt. R. C. Burke 519

3.—Breeding season of the Common Indian Porcupine, (*Hystrix leucura*). By Major F. Wall, I.M.S., C.M.Z.S. 519

4.—The Serow. By H. Shaw Dunn 519

5.—Note on a young Tibetan Gazelle. (*With a photo*). By F. M. Bailey 521

6.—Colour variety of Indian House Crow. By L. C. Glascock 522

7.—On the occurrence of certain Birds in the Darbhanga District, Tirhut. By Charles M. Inglis 522

8.—A Nest of *Archibuteo hemiptilopus* (Himalayan Rough-legged Buzzard) from Tibet. (*With a photo*). By F. M. Bailey 523

9.—Doves nesting on the ground. By C. Wallan 523

10.—Nidification of the Sarus Crane (*Grus antigone*). By Capt. E. O'Brien 524

PAGE

11. Albino Snipe. By H. Gill 525

12.—Flamingos in the N.-W. Frontier Province. By W. P. C. Tenison, R. A. 525

13.—Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in the Punjab. By Capt. J. Lindsay Smith 525

14.—Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in North Behar. By G. J. Monahan, I.C.S. 526

15.—Intelligence in birds. By Major H. Delmé Radcliffe, F.Z.S., Royal Welsh Fusiliers 526

16.—On the habits of birds when danger—supposed or otherwise—threatens their nests. By Stanley Pershouse... 528

17.—The injury feigning habit of parent birds. By Major Arundel Begbie 531

18.—Extension of the habitat of the Common Kukri Snake (*Simotes arnensis*). By Major F. Wall, I.M.S., C.M.Z.S. 532

19.—Discovery of a second specimen of the rare Snake *Oligodon elliotti*. By Major F. Wall, I.M.S., C.M.Z.S.. 533

20.—A case of Hornet poisoning. By Major F. Wall, I.M.S., C.M.Z.S. 533

21.—The Blood-sucking propensities of a bug *Nabis capsiformis*. By N. B. Kinnear 534

22.—Notes from Mansi, Nyu Forest, Upper Burma. By D. H. M. Boyle 535

23.—*Brachymenium turgidum*, Broth, n. sp. By H. N. Dixon 536

24.—An active Mud Volcano. By C. W. Allan 537

REVIEW.—Birds of the Plains by Douglas Dewar 538

OBITUARY.—E. H. Aitken 540

CORRESPONDENCE.—The operations of unscrupulous Egg Collectors 544

PROCEEDINGS OF THE BOMBAY NATURAL HISTORY SOCIETY ... 545

PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY. 551

PAGE

No. 3.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XI. *Oligodon subgriseus* (*With Plate XI. and Diagram and Map.*) By Major F. Wall, I.M.S., C.M.Z.S. 555

THE BUTTERFLIES (*Rhopalocera*) OF THE NIMAR DISTRICT, CENTRAL PROVINCES. By D. O. Witt, I.F.S. 564

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, NO. 4. (*With Plates D. and E.*) By J. C. W. Kershaw and G. W. Kirkaldy 571

THE DRUGS OF SIRSI AND KAPPAT HILLS. By L. B. Kulkarni, L.AG. 574

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA, IX. By E. Meyrick, B.A., F.R.S., F.Z.S. 582

NOTES ON SNAKES COLLECTED IN UPPER ASSAM. By Major F. Wall, I.M.S., C.M.Z.S. 608

ORCHIDS OF THE BOMBAY PRESIDENCY. Part IX. (*With Plate IX*). By G. A. Gammie, F.L.S.................................. 624

THE NESTING HABITS OF THE BAYA. By D. Dewar, F.Z.S., I.C.S. 627

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. (*With Plates D and H.*) By T. R. Bell, I.F.S.......................... 635

PLANTS OF THE PUNJAB. Part IV. By Lieut.-Col. C. J. Bamber, F.L.S., I.M.S. 683

DESCRIPTIONS OF NEW GENERA AND SPECIES OF INDIAN ICHNEUMONIDÆ. By P. Cameron 722

A YOUNG KYANG (*Equus hemionus.*) (*With Plate A.*) By F. M. Bailey 731

THE ADAPTATIONS OF AQUATIC INSECTS TO THEIR ENVIRONMENTS. By Gordon Dalgliesh 732

MISCELLANEOUS NOTES.—

1.—A White Tigress in Orissa.. 744

2.—Panthers taking their "Kill" up trees. By Coleridge Beadon 744

3.—The Call of the Sloth Bear. By P. Roscoe Allen ... 745

PAGE

4.—Brown Rat (*Mus norvegicus*) in Khandeish. By N. B. Kinnear 746

5.—A record Great Indian Rhinoceros (*Rhinoceros unicornis*) 746

6.—Haunts of the Indian Rhinoceros. By Lt.-Col. J. Manners-Smith 746

7.—The Measurements of some of the Horns in the Collection of the Bombay Natural History Society. By N. B. Kinnear........ 747

8.—Do Wild Animals die a Natural Death ? By R. A. Wilson, I.C.S. 748

9.—The Indian Three-toed Kingfisher (*Ceyx tridactyla*) at Matheran. By N. B. Kinnear........ 749

10.—Young Vulture in the sea. By C. A. Wordsworth ... 749

11.—Common Snipe (*Gallinago cœlestis*) in Travancore in April. By G. W. Giles 649

12.—Pintail (*Dafila acuta*) in Baltistan in July. By Lieut. W. M. Logan Home (112th Infantry) 750

13.—Duck-shooting in Rajputana. By Lt.-Col. L. Impey... 750

14.—The Nesting of the Brahminy Duck (*Casarca rutila*). By Lieut.-Col. R. M. Betham (The 101st Grenadiers). 751

15.—Strange behaviour of certain Birds when in possession of strong smelling Insects. By B. B. Osmaston..... 752

16.—The supply of water to young Birds in the nest. By B. B. Osmaston 753

17.—Bird notes from Dunga Gali. By Major H. A. F. Magrath 753

18.—Notes on a Collection of Snakes from Matheran. By Major F. Wall, I.M.S., C.M.Z.S. 756

19.—Notes on a Collection of Snakes made in Baxa Dooars. By Major F. Wall, I.M.S., C.M.Z.S. 757

20.—A Snake flirtation. By G. P. Millett........ 758

21.—Correction of Nomenclature. By E. Meyrick, B.A., F.R.S. 759

PAGE

22.—Some notes on the capture of Butterflies. By H. James.. 759

23.—The early stages of the Hawk Moth, *Theretra palligosta*. By C. E. F. Manson 760

24.—New localities for rare and little known *Sphingidæ*. By C. E. F. Manson 761

25.—Note on the presence of the Coccid Genus *Margarodes* in India. By E. Ernest Green 761

26.—Two Species of "*Chara*" from the Bombay Island. By Vinayak Nanabhai Hate, B. Sc. 762

REVIEW.—BIRDS OF THE PLAINS AND "THE MAKING OF SPECIES", by Douglas Dewar and Frank Finn. 764

THE BIRDS OF BURMA, by Major H. H. Harington, F.Z.S., M.B.O.U........................ 767

PROCEEDINGS OF THE BOMBAY NATURAL HISTORY SOCIETY.. 769

EXTRACTS FROM THE PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY........................ 772

No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XII. *Dendrophis pictus*. (*With Plate XII, and Diagram and Map.*) By Major F. Wall, I.M.S., C.M.Z.S. 775

ON A LOCAL FORM OF THE CHINESE TODDY-CAT, TAKEN IN NORTH BURMA BY CAPT. A. W. KEMMIS, BURMA MILITARY POLICE. By R. C. Wroughton 793

PHEASANT SHOOTING ROUND ABOUT HILL STATIONS IN NORTHERN INDIA. By "Pine Marten"........................ 795

A NEW BLIND SNAKE FROM THE WESTERN HIMALAYAS. By Major F. Wall, I.M.S., C.M.Z.S. 805

THE SEROWS, GORALS AND TAKINS OF BRITISH INDIA AND THE STRAITS SETTLEMENTS. Part I. Introductory Remarks upon the structural characters of Serows, Gorals, and Takins, and Descriptions of the known species of Takins (Budorcas). By R. I. Pocock, F.L.S., F.Z.S. (*With 2 Plates.*) 807

PAGE

NOTE ON THE SEROW (*Nœmorhedus bubalinus*) FROM THE CHUMBI VALLEY. (*With a Plate*). By Capt. F. M. Bailey. 822

NOTE UPON THE SKIN AND SKULL OF A SEROW OBTAINED BY CAPT. F. BAILEY AT CHUMBI IN TIBET. By R. I. Pocock, F.L.S., F.Z.S. 823

NOTES ON SNAKES COLLECTED IN UPPER ASSAM. Part II. (*With a Plate.*) By Major F. Wall, I.M.S., C.M.Z.S. 825

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part VII. By T. R. Bell, I.F.S. 846

SOME NOTES ON THE GIANT SQUIRRELS OF INDIA, BURMA AND CEYLON. By R. C. Wroughton, F.Z.S. 880

NOTES ON SNAKES COLLECTED IN THE JALPAIGURI DISTRICT. (*With a Map.*) By Major F. Wall, I.M.S., C.M.Z.S. 897

NOTES ON THE BIRDS OF CHITRAL (October 1902 to October 1903). By Capt. G. A. Perreau, F.Z.S. (4th Gurkhas) 901

A NEW SNAKE FROM ASSAM, *Oligodon erythrorhachis.* (*With a Plate.*) By Major F. Wall, I.M.S., C.M.Z.S. 923

HISTORY OF THE SEA COCOA-NUT (*Lodoicea sechellarum*, Labill) By E. Blatter, S.J. 925

A FIRST LIST OF MOSSES FROM WESTERN INDIA. By L. J. Sedgwick, I.C.S. 938

PLANTS OF THE PUNJAB. Part V. By Lieut.-Col. C. J. Bamber, F.L.S., I.M.S. 943

REVIEW.—"THE RHOPALOCERA OF JAVA (*Pieridæ*)," by M. C. Piepers and P. C. T. Snellen. 976

MISCELLANEOUS NOTES—

1.—New Langurs from the Indian Empire 978

2.—The food of the Desert Gerbille (*Gerbillus hurrianæ*). By E. Comber 978

3.—Tiger attacking a bear. By Lt.-Col. L. L. Fenton ... 979

4.—A fight between a Hyæna and a Panther. By W. M. F. Pendelbury 979

PAGE.

5.—Mottled Polecat (*Putorius sarmaticus*) at Bannu. By Major H. A. F. Magrath ... 980

6.—A good head of Hodgson's Wild Sheep. (*With a Plate*). By Capt. F. M. Bailey ... 980

7.—The Serow. By C. B. Moggridge ... 981

8.—Habits of the Takin ... 981

9.—A good Chinkara or Indian Gazelle head. By Major R. M. Burton, I.A. ... 982

10.—The Wall-Creeper (*Tichodroma muraria*) in Lyallpur. By A. B. Aitken ... 983

11.—Seasonal change of plumage of the Indian White-Eye. By Capt. G. A. Perreau, F.Z.S. (4th Gurkha Rifles) ... 983

12.—Shrikes' Larders. By D. Dewar ... 985

13.—Common Myna (*A. tristis*) feeding young of Pied Myna (*S. contra*) and Nesting habits of the Common Pariah Kite (*M. govinda*) and Brahminy Kite (*H. indus*). By Chas. M. Inglis ... 985

14.—Change of plumage of the Cinnamon Tree Sparrow (*Passer cinnamomeus*). By G. A. Perreau ... 986

15.—The nesting of a few somewhat rare birds near Mhow. By Lt.-Col. R. M. Betham (The 101st Grenadiers). 988

16.—Birds' nesting in Garhwal. By S. L. Whymper ... 990

17.—Breeding of the Masked Wagtail (*Motacilla personata*) in Kashmir. By Col. L. L. Fenton ... 992

18.—A Note on the nesting of the Besra Sparrow Hawk (*Accipiter virgatus*) and the Andaman Nightjar (*Caprimulgus andamanicus*) in the Andamans. By P. F. Wickham ... 992

19.—Note on Inglis's Bush Quail (*Microperdix inglisi*, Grant). By Charles M. Inglis ... 993

20.—Nesting of the Ibis Bill (*Ibidorhynchus struthersi*). (*With a Plate*). By Capt. F. M. Bailey ... 993

21.—The Snipe-Billed Godwit ... 994

PAGE

22.—Second occurrence of the Snipe-Billed Godwit in Assam. By E. C. Stuart Baker 994

23.—Occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) out of season. By R. K. 995

24.—Late breeding of the Indian Little Grebe (*Podicipes albipennis*). By Charles M. Inglis 995

25.—Intelligence in Birds. By C. H. Donald, F.Z.S. 996

26.—Extension of the habitat of the Sand Snake (*Eryx jaculus*). By Major F. Wall, I.M.S., C.M.Z.S. 1000

27.—A second specimen of the Snake *Oligodon erythrogaster* from the Eastern Himalayas. By Major F. Wall, I.M.S., C.M.Z.S. 1000

28.—A Variety of the Common Cobra (*Naia tripudians*) from Chitral. By Major F. Wall, I.M.S., C.M.Z.S. 1001

29.—The Snakes of Kashmir. By Lieut.-Col. L. L. Fenton. 1002

30.—Do Wild Animals die a Natural Death? By W. G. Betham, I.F.S. 1004

31.—Entomological Notes. By H. Maxwell Lefroy, M.A., F.E.S., F.Z.S.—

- (*a*) The International Congress 1005
- (*b*) The Indian Hemopterid and its food 1005
- (*c*) Storage of Insects 1007
- (*d*) *Alcides* 1007
- (*e*) The Deccan Grasshopper 1007
- (*f*) New Rhyncota 1008
- (*g*) Where *Cicindela* breeds 1008
- (*h*) Attraction to light 1009
- (*i*) The Eggs of *Oligotoma* 1009

32.—Some notes on the Palm *Oreodoxa regia* (*With a Plate*). By J. P. Mullan, M.A. 1010

33.—Environment *versus* Natural Selection as the cause of colouration in Animals. By C. E. C. Fischer 1011

34.—On the occurrence of the Butterfly *Atella alcippe*, Cramer, in Travancore. By Lt.-Col. N. Manders, F.E.S., F.Z.S. 1017

EXTRACTS FROM THE PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY. 1018

LIST OF CONTRIBUTORS.

VOLUME XIX.

PAGE

AITKEN, A. B.; The Wall Creeper (*Tichodroma muraria*) in Lyallpur 983
———, E. H.; Obituary ... 540
ALLAN, C. W.; An active Mud Volcano 537
———; Doves nesting on the ground... 523
ALLEN, P. ROSCOE; The Call of the Sloth Bear 745
ANDREWES, H. L.; Migration of Butterflies 271
———; Peach Leaves as a substitute for Laurel Leaves 273
BACON, Capt. B.; The Cotton-teal (*Nettapus coromandelianus*) in the Konkan, Western India ... 264
BAGSHAWE, L. V.; Tigers and their Prey 253
BAILEY, Capt. F. M.; Note on a Young Tibetan Gazelle 521
———; A Nest of *Archibuteo hemiptilopus* (Himalayan Rough-Legged Buzzard) from Tibet 523
———; A Young Kyang or Tibetan Wild Ass (*Equus hemionus*) (*With Plate* A.) ... 731
———; Note on the Serow (*Næmorhedus bubalinus*) from the Chumbi Valley. (*With a Plate*). 822
———; The Nesting of the Bar-Headed Goose (*Anser indicus*) in Tibet 367
———; Nesting of the Ibis Bill (*Ibidorhynchus struthersi*). (*With a Plate*.) 993
———; A good head of Hodgson's Wild Sheep. (*With a Plate*) 980
BAKER, E. C. STUART; Second occurrence of the Snipe-Billed Godwit in Assam 994

PAGE

BAMBER, Lieut.-Col. C. J., I.M.S.; Plants of the Punjab. A Brief Descriptive Key to the Flora of the Punjab, North-West Frontier Province and Kashmir. Part II. (Continued from page 861 of Volume XVIII) 59
———; Plants of the Punjab. Part III. 370
———; Plants of the Punjab. Part IV... 683
———; Plants of the Punjab. Part V ... 943
BEGBIE, ARUNDEL; The Injury Feigning Habit of Parent Birds. 551
BELL, T. R., I.F.S.; The Common Butterflies of the Plains of India (including those met with in Hill Stations of the Bombay Presidency). (*With Plates E & III*). 16
———; The Common Butterflies of the Plains of India. (*With Plates F and I*) 438
———; The Common Butterflies of the Plains of India. (*With Plates D* and II.)... ... 635
———; The Common Butterflies of the Plains of India. Part VII 846
BERNHARDT, K., On *Teracolus* (*Colotis fausta*) and other species of the Genus 270
BETHAM, Lieut.-Col. R. M.; A Tailless Jackal 518
———; The nesting of the Brahminy Duck (*Casarca rutila*) 751
———; The Nesting of a few somewhat rare Birds near Mhow 988
BETHAM, W. G., I.F.S.; Do Wild animals die a Natural Death? ... 104
BINGHAM, Lieut.-Col. C. T.; Obituary 214

PAGE

Blanford, H. R.; Wild Pigs' Lairs in the rains 254

Blatter, E., S.J.; On the Flora of Cutch. Part II. (Continued from page 777 of Volume XVIII). 157

———————; The Flora of Panchgani 314

———————; History of the Sea Cocoa-nut (*Lodoicea sechellarum*, Labill) 925

Boyle, D. H. M.; Notes from Mansi Nyu Forest, Upper Burma 535

Briscome, T.; A record Great Indian Rhinoceros (*Rhinoceros unicornis*) 746

Burke, Capt. R. C.; A fight between a Hyæna and a Panther.. 518

Burton, Major R. G. (94th Russell's Infantry); The Fear of Man in Wild Animals 276

——————Lieut.-Col. R. G. (94th Russell's Infantry). Some Nature Notes 399

——————Major R. M., I. A.; A good Chinkara or Indian Gazelle Head 982

Cameron, P.; On some Undescribed Bees and Wasps captured by Lieut.-Col. C. G. Nurse in India. 129

———————; Descriptions of New Genera and Species of Indian *Ichneumonidæ* 722

Coleridge, Beadon; Panthers taking their "Kill" up Trees ... 744

Comber, E.; on the Food of the Desert Gerbille (*Gerbillus hurrianæ*) 978

Currie, A. J.; Nesting of the Long-tailed Grass-Warbler (*Laticilla burnesi*) in the Punjab .. 258

———————; The Rufous-backed Sparrow (*Passer pyrrhonotus*) nesting in the Punjab ... 259

———————; Local bird migration 265

Dalgliesh, Gordon; The Adaptions of Aquatic Insects to their Environments 732

PAGE

Davies, H. S.; Malayan Variety of the Sambhur (*Cervus unicolor*). (*With a Photo*) 253

Dewar, Douglas, F.Z.S., I.C.S.: The Nesting Habits of the Baya 627

——————Shrikes' Larders ... 985

Dixon, H. N.; *Brachymenium turgidum*, Broth, n. sp. 536

Donald, C. H., F.Z.S.; Intelligence in Birds 996

Dunn, H. Shaw; The Serow ... 519

Evans, Lieut.-Col. G. H., F. L. S.; "Do Animals die a Natural death?" 273

Fenton, Lieut.-Col. L. L.; The Kathiawar Lion 4

———————————; Tiger attacking a Bear 979

———————————; Breeding of the Masked Wagtail (*Motacilla personata*) in Kashmir. 992

———————————; The Snakes of Kashmir 1002

Fischer, C. E. C.; Environment *versus* Natural Selection as the cause of colouration in Animals. 1011

Gammie, G.A., F L.S.; The Orchids of the Bombay Presidency. Part VIII. (*With plate* VIII). (Continued from page 834 of Volume XVIII.) 139

———————————; Orchids of the Bombay Presidency, Part IX (*With plate* IX) 624

Gibson, R.E., I.C.S.; The Cotton-teal (*Nettapus coromandelianus*) in Sind 263

Giles, G. W.; Common Snipe (*Gallinago cœlestis*) in Travancore in April 749

Gill, H.; Albino Snipe 525

Glascock, L. C.; Colour Variety of Indian House Crow 522

Green, E. Ernest; Note on the presence of the Coccid Genus *Margarodes* in India 761

Harington, Major H. H. (92nd Punjabis). A List of the Birds of the Bhamo District, Upper Burma. 107

PAGE

HARINGTON, Major H. H. (92nd Punjabis). A List of the Birds of the Bhamo District, Upper Burma. Part II. 299

———— Some Rangoon Birds 358

———— F.Z.S., M.B.O.U.; The Birds of Burma... 767

HATE, VINAYAK NANABHAI, B. Sc.; Two Species of "*Chara*" from the Bombay Island ... 762

HOME, LIEUT. W. M. LOGAN (112th Infantry; Pintail (*Dafila acuta*) in Baltistan in July 750

HOPWOOD, J. C.; Occurrence of the Spoonbill (*Platalea cucordia*) in Lower Burma 261

IMPEY, Lieut.-Col. L.; Duck Shooting in Rajputana 750

INGLIS, CHARLES M.; Note on the Slaty-Blue Flycatcher (*Cyornis ceucomelanurus*) and the Common Ruby-Throat (*Calliope camtschatkensis*) in Tirhut ... 259

————; Occurrence of the Peewit (*Vanellus vulgaris*) in Tirhut 262

————; On the Occurrence of certain Birds in the Darbhanga District, Tirhut ... 522

————; Common Myna (*A. tristis*) feeding young of Pied Myna (*S. contra*) and Nesting habits of the Common Pariah Kite (*M. govinda*) and Brahminy Kite (*H. indus*) 985

————; Note on Inglis's Bush Quail (*Microperdix inglisi*, Grant) 993

————; Late breeding of the Indian Little Grebe (*Podicipes albipennis*) 995

JAMES, H.; Some notes on the capture of Butterflies 759

JARDINE, E. R.; Occurrence of the Pink-headed Duck (*Rhodonessa caryophyllacea*) in Burma 264

JUKES, J. E. C., I.C.S.; On the existing "Close time" for Birds and Animals in the Bombay Presidency 216

PAGE

KERSHAW, J.C. and KIRKALDY, G. W.; Biological Notes on Oriental Hemiptera, No. 2. (*With Plate B.*) 177

————; Biological Notes on Oriental Hemiptera, No. 3. (*With Plates C. & I.*) 333

————; Biological Notes on Oriental Hemiptera, No. 4. (*With Plates D. and E.*) 571

KHENGARJI, RAO; The Lesser Flamingo (*Phœnicoptera minor*) in Cutch 262

KINNEAR, N. B.; Measurements of some of the Horns in the Collection of the Bombay Natural History Society 184

————; The Blood-sucking propensities of a Bug (*Nabis capsiformis*) 534

————; Brown Rat (*Mus norvegicus*) in Khandeish ... 746

————; The Measurements of some of the Horns in the Collection of the Bombay Natural History Society 747

————; The Indian Three-toed Kingfisher (*Ceyx tridactyla*) at Matheran ... 749

KIRKALDY, G. W.; see Kershaw, J.C. 177, 571

———— and KERSHAW, J.C.; Biological Notes on Oriental Hemiptera 333

KULKARNI, L. B., L. Ag.; The Drugs of Sirsi and Kappat Hills.. 574

LEFROY, H. MAXWELL; Entomological Notes:—
(*a*) The International Congress 1005
(*b*) The Indian Hemopterid and its Food 1005
(*c*) Storage of Insects ... 1007
(*d*) Alcides 1007
(*e*) The Deccan Grasshopper. 1007
(*f*) New Rhynchota 1008
(*g*) Where Cicindela breeds.. 1008
(*h*) Attraction to Light ... 1009
(*i*) The Eggs of Oligotoma ... 1009

PAGE

MACDONALD, K.; The White winged Wood-duck (*Asarcornis scutulata*) in Tenasserim 263

MAGRATH, Major H. A. F.; Bird Notes from Murree and the Galis 142

———; The Jungle Crow (*Corvus macrorhynchus*) 256

———; Cruelty to Wild Fowl in the Punjab. 265

———; The operations of unscrupulous Egg Collectors 541

———; Bird Notes from Dunga Gali 753

———; Mottled Polecat (*Putorius sarmaticus*) at Bannu 980

MANDERS, Lieut.-Col. N., F.Z.S., F.E.S.; On the occurrence of the Butterfly (*Atella alcippe*, Cramer) in Travancore 1017

MANNERS SMITH, Lieut.-Col. J.; see Smith J. Manners 746

MANSON, C.E.F.; The Early Stages of the Hawk Moth (*Theretra palligosta*) 670

——— New Localities for rare and little known Sphingidæ. 761

MARTEN, JAMES; List of Ferns found at and around Mussoorie, 1908 179

———; Plants gathered in and about Mussoorie during 1908 475

"MARTEN, PINE;" Pheasant Shooting round about Hill Stations in Northern India 795

MEYRICK, E., B.A., F.R.S., F.Z.S.; Descriptions of Indian Micro-Lepidoptera 410

———; Descriptions of Indian Micro-Lepidoptera 582

———; Correction of Nomenclature ... 759

MILLETT, G. P.; Sexual attraction in Lepidoptera 272

———; A Snake Flirtation 758

MOGGRIDGE, C. B.; The Serow ... 981

PAGE

MONAHAN, G. J., I.C.S.; Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in North Behar 526

MULLAN, J. P., M.A.; Some notes on the Palm *Oreodoxa regia*. (*With a Plate*) 1010

NURSE, Lieut.-Col. C. G.; New and little known Indian Hymenoptera 510

OATES, EUGENE W.; Note on the Chinese Crimson Horned Pheasant (*Tragopan temmincki*) ... 260

OGILVIE-GRANT, W. R.; On a new Species of Bush Quail (*Microperdix*) from Goalpara, Assam. With Field Notes by C. M. Inglis. (*With a Plate*) 1

OSBORN, Lieut.-General W., I.A.; The Whooper Swan. A Correction 262

OSMASTON, B. B.; Strange behaviour of certain Birds when in possession of strong smelling Insects 752

———; The supply of water to young Birds in the Nest. 753

O'BRIEN, Capt. E.; Nidification of the Sarus Crane (*Grus antigone*). 524

PEILE, Capt. H. D., I.M.S.; A Correction.—The Butterflies; (*Pieris brassicæ* and *canidia*) ... 269

PENDELBURY, W. M. F.; A Fight between a Hyæna and a Panther. 979

PERREAU, Capt. G. A., F.Z.S. (4th Gurkhas); Notes on the Birds of Chitral. (October 1902 to October 1903) 901

———; Seasonal change of plumage of the Indian White Eye 983

———; Change of plumage of the Cinnamon Tree Sparrow (*Passer cinnamomeus*) 986

PERSHOUSE, STANLEY; On the habits of Birds when danger, supposed or otherwise, threatens their Nests 528

PHILIPE, G. W. V. DE RHÉ; Description of a new Species of Charaxes from the Bhutan Frontier (*Charaxes raidhaka*) ... 270

PAGE

POCOCK, R. I., F.L.S., F.Z.S. The Serows, Gorals, and Takins of British India and the Straits Settlements, Part I. Introductory remarks upon the structural characters of Serows, Gorals and Takins and Descriptions of the known Species of Takins (*Budorcas*). (*With 2 Plates*) ... 807

———————; Note upon the Skin and Skull of a Serow obtained by Capt. F. Bailey at Chumbi in Tibet ... 823

RADCLIFFE, Major H. DELME, F.Z.S. (Royal Welsh Fusiliers); Intelligence in Birds 526

REVIEWS.—Venoms, Venomous Animals and Anti-venomous Serum Therapeutics by A. Calmette, M. D. 210

———— Birds of the Plains by D. Dewar 538

———— The Making of Species by D. Dewar and F. Finn ... 768

———— The Birds of Burma by Major H. H. Harington 768

————, The Rhopalocera of Java (*Pieridæ*) by M. C. Piepers and P. C. Snellen 976

SAVILE, L. H.; The Black-capped Kingfisher (*Halcyon pileata*) in the Thana District 260

SEDGWICK, L. J., I.C S.; A first list of Mosses from Western India 938

SMITH, Capt. J. LINDSAY; Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in the Punjab 525

————, Lieut.-Col. J. MANNERS; Haunts of the Indian Rhinoceros 746

SYMONS. HEUGH S.; Sarus Crane (*Grus antigone*) in Salsette ... 261

————————; Occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) in the Konkan Western India 261

TENISON, Lt. W. P. C., R.A.; The Stiff-tailed Duck (*Erismatura leucocephala*) near Nowshera ... 264

PAGE

TENISON, Lt. W. P. C., R.A.; Flamingos in the N.-W. Frontier Province 525

VENNING, F. E. W.; Habitat of Chinese Pangolin (*Manis aurita*). (*With a Map*) 254

WALL, Major F., I. M. S., C.M.Z.S.; A Popular Treatise on the Common Indian Snakes. Part IX. (*With Plate IX, and Diagram I.*) (Continued from page 735 of Volume XVIII) 87

——————————; Notes on two casualties from the Sawscaled Viper (*Echis carinata*) 266

——————————; A new colour variety of Macclelland's Coral Snake (*Callophis Macclellandi*) and Extension of the habitat of this Species ... 266

——————————; Remarks on Snake Notes in the Last Journal (No. 4, Vol. XVIII). 267

——————————; A Popular Treatise on the Common Indian Snakes. Part X. (*With Plate X and Diagram 1.*) ... 287

——————————; Breeding Season of the Common Indian Porcupine (*Hystrix leucura*) 519

——————————; Extension of the habitat of the Common Kukri Snake (*Simotes arnensis*) 532

——————————; A case of Hornet poisoning ... 533

——————————; Discovery of a second specimen of the rare Snake *Oligodon elliotti*. 533

——————————; Notes on Snakes from the neighbourhood of Darjeeling 537

——————————; A Popular Treatise on the Common Indian Snakes. Part XI. (*With Plate XI and Diagram and Map*) 555

——————————; Notes on Snakes collected in Upper Assam. Part I. 608

PAGE

Wall, Major F., I. M. S., C.M.Z.S.; Notes on a Collection of Snakes from Matheran 756

———; Notes on a Collection of Snakes made in Baxa Dooars 757

———; A Popular Treatise on the Common Indian Snakes. Part XII. (*With Plate XII and Diagram and Map*) 775

———; A new Blind Snake *Typhlops mackinnoni* from the Western Himalayas 805

———; Notes on Snakes collected in Upper Assam. Part II. (*With a Plate*). (Continued from p. 623 of this Volume) 825

———; Notes on Snakes collected in the Jalpaiguri District (*With a Map*) 897

———; A new Snake from Assam *Oligodon erythrorhachis* (*With a Plate*) 923

———; A second specimen of the Snake *Oligodon erythrogaster* from the Eastern Himalayas 1000

PAGE

Wall, Major F., I. M. S., C.M.Z.S; Extension of the habitat of the Sand Snake *Eryx jaculus* ... 1000

———; A variety of the Common Cobra (*Naia tripudians*) from Chitral.. 1001

Wallace, John, C. E.; The Preservation of Natural History Specimens in Airtight Cases ... 502

Whymper, S. L.; Birds' Nesting in Garhwal 990

Wickham, P. F.; A note on the Nesting of the Besra Sparrow Hawk (*Accipiter virgatus*) and the Andaman Nightjar (*Caprimulgus andamanicus*) in the Andamans 992

Wilson, R.A., I.C.S.; Do Wild Animals die a Natural Death?... 748

Witt, D.O., I.F.S.; The Butterflies (*Rhopalocera*) of the Nimar District, Central Provinces ... 564

Wordsworth, C.A; Young Vulture in the Sea 749

Wroughton, R.C.; On a local form of the Chinese Toddy-Cat taken in North Burma by Capt. A. W. Kemmis (Burma Military Police). 793

——— Some notes on the Giant Squirrels of India, Burma and Ceylon 880

LIST OF PLATES.

VOLUME XIX.

To face page

No. 1.

Microperdix inglisi. Plate ... 1
The Common Butterflies of the Plains of India. Plate III ... 22
,, ,, ,, ,, E ... 40
The Common Indian Snakes (Wall) (*Lycodon aulicus*, *Lycodon striatus*). Plate IX ... 88
The Common Indian Snakes (Wall) (*Lycodon aulicus*). Diagram 1 ... 90
Orchids of the Bombay Presidency (*Ærides crispum*). Plate VIII ... 139
Oriental Hemiptera (No. 2) (*Antestia anchorago*). Plate B ... 178
Map (Illustrating distribution of *Manis aurita* and *Manis javanica* in Burma and Assam) ... 254

No. 2.

The Common Indian Snakes (Wall) (*Hydrophobus nympha*, *Xenopeltis unicolor*). Plate XI ... 287
,, ,, ,, Diagram 1 (*Dryocalamus gracilis*) ... 295
Map of Panchgani ... 319
Oriental Hemiptera (No. 3) (*Zicrona cœrulea*) ... 333
,, ,, ,, ,, Plate 1 ... 335
Notes on Snakes from Darjeeling (*Dryophis fronticinctus* and *Oligodon melaneus*) ... 349
Breeding Grounds of the Bar-Headed Goose (*Anser indicus*). Plate A ... 367
Common Butterflies of the Plains of India. Larvæ and Pupæ. Plate 1 ... 445
,, ,, ,, ,, Plate F ... 449

No. 3.

The Common Indian Snakes (Wall) (*Oligodon subgriseus.*) Plate XI ... 555
Map, showing Distribution of ,, ,, ... 561
Oriental Hemiptera, (No. 4,) (*Erthesina fullo.*) Plate D... 571
,, ,, ,, ,, ,, Nymphs. Plate E ... 572
Orchids of the Bombay Presidency (*Vanda Roxburghii.*) Plate IX ... 624
The Common Butterflies of the Plains of India. Plate D ... 634
,, ,, ,, ,, Larvæ and Pupæ. Plate II. 648
The Tibetan Wild Ass (*Equus hemionus*)— Plate A ... 731

No. 4.

The Common Indian Snakes (Wall) (*Dendrophis pictus*). Plate XII ... 775
,, ,, ,, ,, (*Dendrelaphis tristis*). Diagram 1 ... 779
,, ,, ,, ,, Map showing Distribution of *Dendrelaphis tristis* ... 786
The Bhotan Takin (*Budorcas taxicolor*) ... 807
Horns of Sze-Chuen, Bhutan and Mishmi Takins ... 814
The Himalayan Goat-Antelope or Serow (*Nemorhædus bubalinus*). Plate B ... 822
Notes on Snakes collected in Assam (*Dendrophis gorei*, *Bungarus niger*, *Bungarus lividus*) ... 829
A New Snake from Assam (*Oligodon erythrorhachis*) ... 923
Head of *Ovis ammon* ... 981
The Ibis-bill (*Ibidorhynchus struthersi*)—
Some Notes on the Palm (*Oreodoxa regia* ... 1010

ERRATA AND ADDENDA.

(VOLUME XIX.)

Page 115, line 9, *for* Pomathornis *read* Pomatorhinus.
,, 261, lines 31 and 35, *for* leucordia *read* leucorodia.
,, 307, line 19, *for* Pisttacidæ *read* Psittacidæ.
,, 310, ,, 11, ,, cormandelica *read* coromandelica.
,, 311, ,, 9, ,, Charadridæ *read* Charadriidæ.
,, 360, ,, 32, ,, perigrinus *read* peregrinus.
,, 363, ,, 15, ,, ispidsa *read* ispida.
,, 364, ,, 29, ,, Peudogyps *read* Pseudogyps.
,, 530, ,, 23, ,, *στορλη read στοργη.*
,, 549, ,, 41, ,, Ehis *read* Echis.
,, 555, bottom line, *for* Nanwang *read* Namsang.
,, 566, line 23, *for* Acræanæ *read* Acræinæ.
,, 569, ,, 22, ,, Papilo *read* Papilio.
,, 608, fourth line from bottom, *for* 2 *read* 1, and *for* 20 *read* 9.
,, 610, line 15, *for* imagoes *read* imagines.
,, 612, eighth line from bottom, *for* 9 eggs *read* 19 eggs.
,, 614, the figure referred to at line 17 from top of page was omitted but appeared on page 837 (No. 4, Vol. XIX).
,, 617, lines 4 and 13, *for* exovration *read* exovation.
,, 622, line 18, *for* Qwalla *read* Gwalla.
,, 653, ,, 37, ,, Hypolimnus *read* Hypolimnas.
,, 653, ,, 40, ,, horsefieldi *read* horsfieldi.
,, 754, bottom line of page, *for* Acanthopueusta *read* Acanthopneuste.
,, 775, on Frontispiece (Coloured Plate No. XII) *for* DENDROPHIS PICTUS *read* DENDRELAPHIS TRISTIS.
,, 776, 4th line from bottom, *for δεγδρον read δενδρον.*
,, 784, expunge last line.
,, 785, expunge first six lines.
,, 787, last line but one, *for δευδροτ read δενδρον.*
,, 826, *for* 5 in third column of remarks *read* 6.

P. T. O.

Page 828, Explanation of text figure :—

(*a*) maxilla.
(*b*) dentary part of mandible.
(*c*) nasal bones.
(*d*) ridges for muscular attachment on parietal.

,, 903, line 11, *for* Lopophanis *read* Lophophanes.
,, 903, ,, 3, ,, Alticeps ,, Atriceps.
,, 906, ,, 36, ,, Syphia ,, Siphia.
,, 910, ,, 21, ,, Adelur ,, Adelura.
,, 916, ,, 13, ,, brachydactila ,, brachydactyla.
,, 916, ,, 34, ,, torquilli ,, torquilla.
,, 918, ,, 24, ,, govindha ,, govinda.
,, 919, ,, [illegible], ,, Faloo ,, Falco.
,, 1001, 27th line from top, *for* right *read* left.

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JOURNAL
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Vol. XIX. BOMBAY. No. 1.

ON A NEW SPECIES OF BUSH-QUAIL (*MICROPERDIX*) FROM GOALPARA, ASSAM.

By

W. R. Ogilvie-Grant,

with field notes by C. M. Inglis.

(With a Plate).

Microperdix inglisi, sp. n.

Adult male.—Very similar to the male of *M. manipurensis* (Hume), but paler and much greyer, especially above : the black markings on the upper parts are much reduced and take the form of narrow bars which, on the lower back and rump, are mostly confined to the basal half of the feathers ; on a few of the scapulars the black bars towards the end of the inner web are wider and, being more or less confluent, form irregular blotches ; the chest-feathers are nearly uniform grey, with only rather faint blackish shaft-streaks ; which become wider at the extremity, the middle of the breast and belly is paler buff, and the black markings are very much narrower.

Total length about 6·5 inches ; wing 3·4 ; tail 2·0 ; tarsus 1·05.

M. inglisi, Grant.

Adult female.—Greyer than the female of *M. manipurensis*, especially on the mantle where the feathers are grey, and are merely margined at the tip with blackish and not conspicuously blotched with black as in *M. manipurensis* ; the exposed portion of the feathers on the remainder of the upper parts is also much greyer and the black markings, which are confined to the basal half of the feathers are hidden.

Total length about 6·3 inches : wing 3·25 ; tail 2·0 ; tarsus 1·0.

Habitat.—Goalpara, Assam.

This interesting new geographical form was first procured at Goalpara in the Brahmaputra Valley by Mr. C. M. Inglis who forwarded specimens to the Bombay Natural History Society together with a drawing. Mr. Inglis rightly believed the birds to belong to an undescribed form distinct from *M. manipurensis* and on this account Mr. W. S. Millard submitted the birds to me for examination and for comparison with the types of *M. manipurensis* (Hume). In the British Museum there is a ragged skin of a female *microperdix* which was received in 1893 from the Calcutta Museum and said to have been procured in Bhutan Doars. This bird is no doubt referable to *M. inglisi.*

FIELD NOTES ON *MICROPERDIX INGLISI*, BY C. M. INGLIS.

Whilst staying with my friend Mr. A. M. Primrose at Mornai Tea Estate in the Goalpara District of Assam, I had several opportunities of studying these birds and the following notes are compiled from my own observations and also from those of Mr. Primrose who kindly allowed me to use his notes. We identified the bird as Hume's Bush-Quail, but on my sending a sketch home Mr. Ogilive Grant said he expected it was a new species, and on my sending a series of skins they confirmed his opinion and he has paid me the compliment of naming it after me.

This Quail is, if anything, the commonest quail got in that garden, but on account of the nature of the jungle it frequents it is seldom seen and difficult to get. They are found in damp, dense ekra jungle which grows in the nullahs and when these get inundated during the rains they move into higher pieces of ekra and also into the sungrass. We have never seen them on absolutely dry ground except when feeding, at other times they keep exclusively to the damp nullahs. Our observations are mainly confined to the cold weather and up to April as after that the jungle is too heavy to walk through or have beaten. They are excessively local birds, only certain patches of jungle holding them and they frequent the same spot year after year. Although there may be, what appears to us, identical patches of ekra in the same nullahs and which one would think should contain these quail still none will be found in them. One very soon gets to know which patches are worth beating and which not. Many of these birds must get destroyed in the fierce grass fires which rage in that part of Assam during the early part of the year. A good method of getting these birds is as follows :—

A day or two before the beat takes place, burn patches in the nullah leaving those which contain the birds. This has to be done carefully. This thinning of the jungle gives one a better chance, as it leaves the birds fewer spots to put up in when flushed and also fewer wounded birds get lost. Without doing this it is very difficult indeed to retrieve wounded birds as they run a lot and have a knack of getting over the ground at a good pace. A good dog or two would of course be of great service both for retrieving and putting up the birds. Burning the grass in front of one as one goes along is no use as the birds only run before or else through the fire and will not take to flight. They are usually seen in covies of four to six, but during March and April they get into larger ones containing from six to twelve birds or perhaps even more. On the 28th March, Mr. Primrose wrote that they were *exceedingly plentiful* and that he picked up four during one evening's stroll. He had hopes of obtaining the eggs but up to date these are still *desiderata.* The covies separate on being disturbed, some flying on ahead and others back over the beaters. They are not difficult to flush a second and even a third time with a sufficient quantity of good beaters. At first they rise straight up in the air and they go off with a straight steady flight for about fifty yards and then drop suddenly. This habit they have of dropping suddenly, often makes one believe that one has missed one's bird instead of which it is probably stone dead where it fell and also *vice versa* On touching the ground they either start running at once or else if the beaters are close up they will squat. It is most difficult to spot them either running over or squatting upon the burnt grass for their colour matches that of the ash most perfectly. When they squat they sit very closely being sometimes picked up alive by the beaters. Their note is like that of The Painted Bush-Quail (*Microperdix erythrorhynchus*) and is often uttered when the covey separates. As far as we could observe males outnumbered females. Their food consists principally of seed. They very occasionally are flushed from the edge of the tea. We, on several occasions, came across covies feeding in the open on the burnt ground up to about mid-day and probably during dull weather they feed there all day. With fair luck and straight powder, two men, one taking each side of the nullah, ought to be able to account for every bird in it. Our biggest bag for a morning was eight birds, but that I am certain could easily be beaten in a place like Mornai. They are known by the name of '*Kala goondri*' at Mornai Tea estate where all our specimens were obtained. Adults showed signs of breeding in the beginning of March and we were fortunate enough in obtaining a fully fledged young one on the 11th of January. This is shown on the plate accompanying these notes. This is, I believe, the first time the young bird has been obtained.

The colours of the soft parts are as follows :—

Adult —Bill, dark grey, base of mandible lighter and in some specimens this is tinged with yellow. Tarsus orange red, toes and back of tarsus lighter, claws light brown. Iris brown.

Nestlings.—Bill, upper mandible except base and lower mandible except tip dark greyish, remainder of lower mandible and base of upper mandible albescent. Tarsus fleshy, back of tarsus and toes yellower. Iris brown.

THE KATHIAWAR LION.

BY

LIEUT.-COLONEL L. L. FENTON.

In spite of the fact that a certain amount of protection is accorded to Gir lions by the Junagadh Darbar, there cannot be the slightest doubt that they are gradually, but surely, approaching extinction. Not so very many years ago they were to be found in fairly considerable numbers in the country round Gwalior, Goona, Saugor, Khandeish, Jhansi, and even as far eastward as Allahabad. The districts, round Mount Abu, Deesa and Ahmedabad, along the banks of the Sabarmatti river as far as the Runn, were also favourite localities for them. In an old sporting magazine I have read that in the year 1832 the officers of the 23rd Bombay Cavalry used to hunt lions on horseback in the Deesa districts, in what way it was not stated, and an old well-known officer, formerly of the Central India Horse, informed me that during the time he was with this regiment no less than 26 lions were shot by the officers in Central India.

They have, however, long since disappeared from all these localities. The last lion that was, I believe, shot outside Kathiawar, was shot on the Deesa race-course, by the late Colonel Heyland of the old 1st Bombay Cavalry. This was over 40 years ago. It was rumoured, a few days ago, that another one had been seen somewhere in the same neighbourhood, but this could not be proved. In Kathiawar itself, some lingered for a time in the Barda and Aleche Hills in the South and in the wild tracts round Chotila, known as the "Tanga," and in parts of Dhrangadhra, Jasdan, and a few other States in the North of the Province. Then they were heard of only in the Gir Jungle which has always been their home in the Girnar Hill, which, before it was isolated by the march of cultivation, was practically part and parcel of the Gir, and in the Barda Hills, which lie about 10 miles north of the Port of Porbandar, a very rugged group measuring about 10 miles across, covered where the soil allows of it, with low jungle, which, also before their isolation owing to the same cause, were connected with the Gir by way of the Aleche hills and the then rough country extending between Dhank and Chorwar on the sea coast. When, however, with the gradual settlement of the country, these last two favourite haunts were cut off from the Gir by cultivation, the lions were compelled to desert them too, and confine themselves to the Gir. The story goes that the Bardas were deserted by them in consequence of the guns fired on the hills by the British Force sent in pursuit of the Waghir rebels. Doubtless they disappeared about the same time, but I am confident that the *real* reason for their doing so is the one I have stated above.

At one time, they must have been fairly numerous in the latter hills, which before the famine abounded in their natural food, *viz.*, sambur and pig besides being the grazing ground in the hot weather of all the cattle in the low country surrounding them. The late Jam Vibhaji of Navanagar told me he had shot lions there as a young man, and there is a curious fresco painting on the walls of one of the rooms in the Lakola at Jamnagar depicting a former ruler, *viz.*, Jam Ranmalji, engaged in the same sport, in the company of his Bhayat with a following of Khawases and armed retainers.

Occasionally, even now, during the monsoon when the crops are high, a lion or a party of them find their way into the Bardas as well as into the Girnar. At the commencement of the Porebandar Administration, about 23 years ago, a party of three, *viz.*, a lion, a lioness and a cub, made their appearance in the hills. Mr. Sealy, the then Administrator, wished to preserve them, but they were don to death by the Rabaris and the Navanagar Police stationed there at the time, to keep out the Mekrani outlaws against Junagadh. I saw the skin of the lion afterwards in the possession of an officer; it was a very fine animal with a fairly good mane. The Girnar Hill being so much nearer the Gir than the Bardas, occasional visitors to it are not so rare: I was told by Mahomed Khan, the successor of the old Balooch Inamdar of Kadia, a village at base of the south-eastern slopes of the hill, that a few years ago a young lion made its appearance in his village and killed a cow belonging to one of the villagers. It was followed up the next morning by the owner of the cow, a Mecrani sepoy in the service of the old Baloochi. He came suddenly upon the lion in the act of devouring the carcase, on the outskirts of the village, in a prickly-pear thicket. The lion charged at once, knocking over the sepoy and mauling him badly, but the latter kept his presence of mind, and succeeded in driving the beast off, after inflicting such severe wounds upon it with a "jambia" or short covered dagger, that it succumbed to them before going any great distance. The old sepoy, when I saw him, not long after the encounter, had quite recovered from his wounds.

Another adventure with a stray lion took place in a Sindhi village, not very far away from the same neighbourhood. The story was told me by an eye-witness. In this case, a cultivator, early one morning while on his way to his fields, came across a lion devouring a cow it had just killed. He immediately hurried back and gave the information in the village when practically the whole of the village population turned out armed with tom toms, empty tins, lathis, etc., for the purpose of driving the unwelcome visitor away. On seeing the crowd approaching, the lion left the " kill " and retired into some bushes, whence it declined to stir, in spite of all the efforts of the villagers to make it do so. Some of the men bolder than the rest managed to reach and climb into some trees overlooking the bushes into which the lion had retreated and tried to make it move by pelting it with stones, but all to no purpose, a few ominous growls was all they elicited in response to their fusillade. At this stage in the proceedings, a "Rabari" appeared upon the scene, a cattle-herd by caste and profession, and a member of one of the handsomest, pluckiest and finest class, of the many to be found in the Province. On learning from the villagers, the cause of all the uproar, he, instead of following their example of joining in the fun from the same position in a tree, laughed at them for their cowardice, and declared he would single-handed very soon put the lion to flight. To put his boast into effect, he at once proceeded to walk towards the spot where the lion was said to be crouching, shouting at the top of his voice and brandishing his lathi as he did so, and doubtless quite convinced in his own mind, that the lion would turn tail and bolt on seeing him steadily approaching, and probably it might have done this, under any other circumstances, but it is not surprising that, after all the baiting that it had undergone, at the hands of the villagers, its temper at the time was not of the sweetest, and that instead of at once decamping, it charged and laid low the unfortunate "Rabari" with a gaping wound in his side which rapidly proved fatal.

A short account of the Gir Lions, in whose haunts I have lived for weeks together and with whose habits, I have therefore perhaps had a better opportunity of becoming acquainted than most members of our Society, may not be out of place in our journal, especially as I do not remember to have ever before seen them mentioned in its pages. The Gir forest, where only the lions are now found, covers an area of about 1,500 square miles within the territories of the Nawab of Junagadh. The greater part of it is covered with a jungle of stunted trees composed principally of dwarf teak, jambool, khizda, khakra, kadaya, bor and babul with here and there, patches of bamboos, corinda and other thorny bushes, and an isolated wadh or banyan tree towering far above its neighbours. The country is undulating with a few rugged hills in parts and much cut up by nalas, with rough rocky beds, and their banks as often as not, lined with a thick growth of jambool trees. The "Thran" river is the largest stream in the forest, and in ordinary years it, with some of the larger nalas, holds water all the year round in the deeper pools. Rock is almost everywhere near the surface, which accounts for the stunted growth of the trees and, I imagine, the rank coarse vegetation which covers the jungle during the monsoon, rendering it almost impenetrable in parts, at that season of the year. Villages, if a collection of dilapidated huts surrounded by patches of cultivation can be looked upon as such, are few and far between. Sasan, which is the head quarters of the local Darbari official and where shooting camps are as a rule pitched, may be looked upon as the capital of the Gir. Nesses or hamlets, being collections of temporary huts, the dwelling places of local herdsmen such as Rabaris, etc., are scattered in suitable localities all over the forest. As might be expected a very bad type of malarious fever prevails both in the Gir and in parts of the Girnar. The greatest sufferers from it are of course the outside cattle grazers who visit the forest only at certain seasons of the year, with swarms of cattle for temporary grazing purposes, and more especially so the cultivators and their families, who are from time to time imported by the Darbar into the Gir whenever it is considered advisable to establish a new village. In the village of Hasnapur, comparatively recently established in the crater of the Girnar, almost every soul I saw was suffering from enlargement of the spleen. A former village on the same site had undoubtedly been wiped out by the same disease. The site is admirably adapted for a game preserve and I am surprised the Darbar does not reserve it for such a purpose, instead of keeping up the village. The panthers have only to be kept down ; Sambur, Pig, *Gimtada* (Four-horned Antelope) are already there, and Chital might be imported as a trial. The actual natives of the Gir are, as might have been expected, practically immune from the fever. The most noticeable class amongst these—are the descendants of men who were originally imported into the country by the Darbar probably to serve as mercenaries, and who intermarried with the natives and settled down in it for good. Many of them are still to be found in the service of the Darbar in the ranks of the police sibandi, etc. Physically they are a very fine set of men, and some of the best shikaris and trackers in the world. They are the shikaris of the Gir, and no lion shoot is ever undertaken without the services of certain well known men amongst them, being called into requisition. For many years one Hebat of Jambuda was considered the best man and took the principal part in all the big shoots—but of other younger men, coming on in the same direction, there is no scarcity. So much for the lion country and its people.

As regards the wild beasts to be found in the Gir besides the lion, as far as I am aware it was never the resort of the tiger or the bear and it may be added by the way that it does not hold any description of jungle or spur fowls. Of the undermentioned animals however when I knew the Gir, in its prime, before the last famine, the jungle was practically full, *viz* :—

	Local vernacular name.
Panther	*Dipdo.*
Hyæna	*Jarak.*
Pig	*Soor* or *Kalajanawur.*
Sambur	*Sembur.*
Spotted Deer	*Pasu.*
Four-horned Antelope	*Guntada.*
Nilgai	*Roz.*
Gazelle (in the more open parts)	*Chikara.*
Blackbuck (on the outskirts)	*Kalyar* (doe, *reda*).

The local vernacular name of the lion is *Sawaz*, *i.e.*, one who causes the flocks to bleat. Sometimes but very rarely it is called the *Untia vagh* obviously from the fact of its colour being somewhat similar to that of a camel.

In the matter of food, therefore, the lions were well off with the game alone, in addition, they had the swarms of cattle which were brought into the Gir from outside to graze and which undoubtedly paid a heavier toll to them than did the wild game.

I have not paid a visit to the Gir since the last famine, but have been told by others who have done so, that in the matter of game, it is a very different place to what it used to be "in the good old days." Until towards the end of the famine by which time the Gir had been pretty well cleared of both wild game and cattle, the lions and panthers fared no worse than usual, but it was a very different state of things for all the deer kind: not only did their natural food very soon failed them but from the very commencement of the famine they were mercilessly persecuted by the local Darbari police, forest guards, etc., who were able to and did shoot down hundreds of animals over the puddles of water left in the district, in spite of the orders of the Darbar prohibiting their slaughter. In the depths of the Gir the lower Darbari officials do pretty much as they like. An old sepoy once laughingly said to me that he was accustomed to eat meat and the Gir was the only place where he could get as much as he required. This was when the game was supposed to be preserved!

Towards the end of the famine the lions as well as the panthers began to find their food was running short, they were therefore forced to leave their usual haunts, and wander in search of it into the surrounding districts. This brought them more into evidence, and gave rise especially at the time of Lord Lamington's shoot which terminated so disastrously, to the rumour that owing to the very strict protection which had been accorded them, the lions had increased enormously in numbers. This I feel safe in stating was not the case. As a matter of fact the preservation was never very strict. The Darbar was always very liberal in granting the local officers and others permission to shoot a lion; all the cubs captured in the Gir were invariably sent to Junagadh to be placed in confinement in the gardens, and I was told as a fact that the Rabaris or local cattle herds, who naturally had no love for the lions, made away with any cubs they came across if they found there they could do so without fear of detection. Moreover, although there are no lions in Baroda territory, which bounds the Junagadh Gir on the east, some of the best jungles for lions on the Junagadh side abut on this boundary and I should be sorry to say how many lions have been killed by their not keeping within their own limits, to put it as mildly as possible. With no recent information to go upon I cannot give an approximate estimate even, of the number of lions in the Gir at the present day, but it may be taken for granted that if the Gir is allowed to be cut down in the future as it has been in the past, the day is not far distant when the Indian lion will have become extinct. Fortunately the loss of the forest would mean far more not only to Junagadh itself but also to the whole of Kathiawar, than the loss of the lions, so let us hope that they will be spared for many a long day yet. Of course, the lions do a fearful amount of damage among the cattle, but this might be remedied to a great extent by properly preserving the game animals which are their natural food. These are, it is true, *nominally* preserved now but as a matter of fact the forest guards and police, who are supposed to be the gamekeepers, have an understanding amongst themselves that the game laws are intended for others and not for themselves. For the better preservation of the lions the sooner the wholesale and indiscriminate slaughter on the part of these subordinate officials is stopped the better. I have often wondered why the Darbar does not close some 600 square miles of the Gir not only as a reserved forest on the lines obtaining in British India, but to serve also as a sanctuary for the lions and all descriptions of wild game. It is worth the trial and there are several localities well adapted for the purpose, notably the country including the Nesses of Sirwan, Khokra, Chelna, Moduka and Jamwadla.

It is curious that the old idea, that the Indian lion is a maneless one, still prevails amongst a host of people not excepting sportsmen who have never had an opportunity of seeing the animal. Any one who has taken the slightest interest in the subject is of course well aware that such is not the case. It is true that in a wild state the Gir lion does not carry as heavy a mane as the African, but this comes of the former's home being in a thorny jungle where its mane is bound to suffer, whereas the latter is more or less a dweller of the plains. In captivity there is not much to choose between the two in this respect, although I have noticed that in the Indian animal the mane does not extend so far under the body as it does in the African. It has also been stated that the Indian lion is a much smaller beast than its African brother. To decide this question we can only refer to the measurements taken and recorded by sportsmen, and unfortunately very few measurements of the Indian animal are to be found recorded anywhere. Moreover, there is nothing to show that in every instance the measurements were taken in exactly the same way which must have been done for them to be of the slightest value for purposes of comparison. It was stated shortly after Lord Lamington's shoot already referred to, that of the lions shot by his party one, if not two, measured over 11′ ! Subsequently it transpired that the measurements were taken *after* the animal or animals had been skinned. I was unable to ascertain whether the measurements stated recorded the length of the skins or of the bodies after the former had been removed, anyhow the measurements are obviously of no value, and it may be regarded as a certainty that a lion of the dimensions stated—the measurements being taken in the recognized way before the removal of the skin—never existed in the Gir or anywhere else in India. Of four Gir lions shot and very carefully measured by myself, the total length of the largest was 9′-5″, the length of the tail being 2′-11″. Two of the others measured, respectively, 9′-1″, and 9′, both being younger animals than the first. The one shot by Lord Harris measured 9′-7″, another by the late Lieut. Percy Hancock was a still finer beast but unfortunately its measurements were not taken.

In Rowland Ward's Book of Measurements, 3rd edition, mention is made of African lions measuring from 9′-1″ to 10′-5″ only, four being 10′ in length and some ten below 9′-5″ not including lionesses of course, as they are always smaller than the males. In the same book of records, I notice it is recorded, that a 10′-4″ lion has a body measurement of 7′-2″, a 10′ lion, of 6′-10′ and one of 9′-8″, a measurement of 6′-6½″—this goes to show that the tails vary considerably in length and the weight of an animal cannot be judged correctly simply from its total length. Besides abnormally large-sized specimens are to be found in every description of animal life. Moreover, when comparing the whole area of Africa with a small one like that of the Gir Jungle—“ a drop in the ocean”—it is by no means extraordinary, that the few larger specimens should have been recorded from Africa, especially as so few measurements of the Indian animal are forthcoming. For a true comparison we must look to the *average* measurements, and these undoubtedly prove the latter to be every whit as fine a beast as the African.

A comparison of the skull measurements is interesting. Those of my 9′-5″ lion are as follows :—

Total length between uprights	...	13·4 inches.
Width across the zygomatic arches ...		8·6 ,,
Height resting on table ...	...	6·2 ,,

In Mr. Rowland Ward's Records of Measurements, those of over 30 lions run much higher than the above—the largest measuring no less than 16·5″ in length. But these, of course, belong to *picked* heads from all parts of Africa, and they certainly do not shake my belief that taking the *average* there is no difference in point of size between the two animals. A lion, which was presented to the London Zoological Gardens by the late Colonel Humfrey, was as fine a specimen as any of the African lions in the adjoining cages, and the lion confined in the Sardar Bagh at Junagadh will compare favourably in the same direction with any African specimens in confinement in any part of the world.

My 9′-5″ lion's skull measurements compare as follows with those of a very heavy old 9′-8″ tiger I shot in North Kanara.

		Skull	*Measurements.*	
	Length.	*Length.*	*Breadth.*	*Height.*
Tiger	9′-8″	13·7 ins.	9·3 ins.	6·3 ins.
Lion	9′-5″	13·4 ,,	8·6 ,,	6·2 ,,

The principal difference is apparent in the *breadth*, the tigers' being consequently the much heavier looking skull.

The chief difference between the skulls of the two animals lies in the nasal bones, the posterior terminations of which, in the lion, are opposite the terminations of the maxillary bones, whereas in a tiger, they extend beyond them. The lower part of a lion's underjaw is also convex and does not sit flat on a table like a tiger's does.

In a description given of the Indian lion by the great authority, Lydekker, in his book on the Great and Small Game of India, Burma and Tibet, he considers it possible that a claim to racial distinction between the Indian and African animals may be drawn from the colour of the mane. He states that he himself has never *heard* of the occurrence of a black maned lion from the former country and further mentions that it is definitely recorded by a Colonel Percy in the Badminton Library, that black maned lions are *absolutely unknown* in India. I cannot, of course, say what grounds Colonel Percy had for making such a downright assertion applicable to the whole of India. He evidently had no experience of the Kathiawar lion, for there is sufficient evidence, I consider, satisfactorily to prove that black maned lions have been known to occur in that Province.

The evidence I refer to is as follows :—

(1). Many of the Gir *pagis* including one old and very celebrated one of the name of Hebat, who, I fancy, is now dead, have *over and over* again told me that black maned lions did occasionally occur in the Gir and had actually been seen either by themselves or their fathers before them. These men were not called upon to settle the question of manes—they only knew the lion of their own country, lions with black manes had been known to exist, and therefore they stated as much. By the side of further evidence I had no reason to doubt their word, although I had not myself come across a lion with a wholly black mane.

(2). The late Colonels Watson and Scott, both of whom were very well acquainted with the Gir and its lions—the former especially so—have on more than one occasion mentioned in my presence the rare occurrence of lions with black manes in the Gir. The former was a very observant officer and a great *shikari*, and one who would not have made such a statement had the slightest doubt existed in his mind on the point.

(3). In an old Agency document which came before me in a case in which the Junagadh Darbar and an old Kathi Chief, one Harsur Khachar (formerly of Chelna in the Gir) were the interested parties, (I am stating these particulars in order to locate the evidence should any one hereafter care to see it), it is incidentally stated to the effect that " Colonel Le Grand Jacob, while on his way to the Gir to shoot *a black maned lion*, had been obliged to give up the expedition and return to Rajkot to transact some important business which had to be seen to without delay."

This piece of evidence is in itself sufficient, I consider, to remove all doubts upon the point.

(4). I saw the lion mentioned before which was shot by the late Lieut. Percy Hancock. It was a fine beast with a good mane. *I noticed several black locks in the latter.* Of course, a few black hairs do not make a black mane, but the black locks were unusual, and had the lion lived, the whole mane might in course of time have turned black.

Shortly—the occurrence of black manes amongst the Kathiawar lions is extremely rare, but that they do occasionally occur I consider there is sufficient evidence to show. More evidence on the point could possibly be adduced by any resident interested in the subject, from the Gir *pagis* who would certainly have noticed the occurrence of any black manes amongst the lions of more recent generations.

The lion is a far more noisy animal than the tiger and for this reason is more easily brought to bag, being so much more in evidence. They generally commence roaring early in the night and often kept it up until the dawn for no apparent reason. When arranging for a shoot it is usual, besides tying out *kills*, to locate *pagis*, in parties of two, in different parts of the jungle overnight; these ascertain during the night the direction in which any lions are moving, by their roars, and as soon as it is light enough to see, pick up the tracks which they never leave until they have marked down the animal or animals, as the case may be, either busy over a kill or more often resting for the day, resting under the shade of a large *wadh* or banyan tree, or sometimes, in a *bohira* or waterhole to which they are very partial. A *pagi* told me that while watching one evening over one of these *bohiras* he saw a hyœna, two porcupines and finally two lions emerge from it at short intervals! On another occasion, while watching over one of them myself no less than three lions came out of it. The first one that did so was shot by one officer who was watching with me, but when the remaining two came out, it was too dark to see them, although I heard them growling only a few yards away under my tree. Since the lions, as a rule, cover a great deal of ground during their nightly wanderings, the spot where they are eventually marked down may be many miles away from camp.

Having located them for the day one *pagi* remains to keep a watch over them, while the other one goes off with the *khubber* to one of the sowars who have been stationed beforehand in several convenient localities and the latter, in his turn, takes it at once, to the sportsman's camp. A lion having been marked down, there are two ways of bringing it to bag, *viz.*, either by driving in the usual way, or by walking it up. The former method is usually resorted to, but the latter is by far the more certain way of getting a shot, although for obvious reasons a good deal more risky in other respects. I have tried both ways and have been more successful with the latter, but on two out of three occasions on which I resorted to it I had rather narrow escapes from charges. I have also heard of lions being shot by sitting over goats—more than one lion has met his end in this (to a lion?) ignominious way on the Amreli border. One sportsman told me he had bagged his only lion by sitting up in a tree, over one of the *bohiras* already mentioned with a kid. When the latter was made to bleat, the lion appeared at once and was shot.

To show the amount of damage the lions do amongst cattle I may mention that the last one I shot was one of two which had during the previous night broken into the cattle zareba of a Rabari Ness, killed three cows and mauled two more. A sixth was missing when I arrived on the scene. This one we found later on quietly grazing near the lions while they lay fast asleep under a *wadh* tree quite two miles away from the Ness, having evidently been driven along by them to serve for their next meal.

In conclusion, I would remark, that it is somewhat extraordinary that the British Museum has not, as yet, been able to procure a single specimen of this fast disappearing animal for its collection. The authorities there have, it is true, been promised a specimen but so far the promise has still to be kept. A skin they would have obtained a short time ago but the latter was not sufficienlty perfect for setting up. Our own Society too, I am aware, is desirous of obtaining a specimen for the same purpose. It is not too late yet for the deficiency in both Institutions to be made good, and I trust that His Highness the Nawab of Junagadh may be able to see his way before very long to make what will be a most valuable present to one if not to both Museums. In the event of such a handsome offer being made, it will certainly be very advisable for our Society to send an expert taxidermist to the Gir to superintend the skinning and preservation of the specimen, otherwise I am afraid disappointment will only result.

KASHMIR, 12*th Nov.* 1908.

Note.—(Since the above was written the Society has been presented with the skin of a young male Lion by His Highness the Nawab of Junagadh. The specimen which was shot by Mr. Dudley Myers on the 7th March 1909 was obtained through the instrumentality of two of the Society's members—Mr. C. H. Hill, C.I.E., I.C.S., and Mr. W. H. Lucas, I.C.S., and measured between uprights:—

Length of head and body........................	5′-6″
„ „ tail..	2′-8″
or a total length of..............................	8′-2″

The skin is being forwarded to England to be mounted for the Society's Museum.—EDS.)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

(INCLUDING THOSE MET WITH IN HILL-STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(*With Plates E and III.*)

This series of papers has progressed so far but slowly. Begun in Vol. XVI of this Journal, Part 4, at page 570, it reached the third instalment only in Part 4 of Vol. XVII at page 921. Mr. L. C. H. Young, who had been induced to undertake the writing of it somewhat unwillingly, had to go home on account of ill-health in the middle of last year and shortly afterwards succumbed to an operation which was found to be necessary. By his demise the Society has lost one of the most useful of its members who, in the Entomological Section, laboured early and late to put some sort of order into the collections which, up to the time of his intervention, had received very little attention indeed. Mr. Young made order out of chaos and cabinet after cabinet now stand in the Society's Rooms, an eloquent witness to his energy and neatness, containing long series of butterflies, moths and other insects, all beautifully labelled and arranged in their proper places. An obituary notice appeared at page 184 of Vol. XVII, Part I of the Journal, a regretful tribute to his memory.

Mr. Young was a man of essentially scientific habit of thought with an innate contempt for anything in the nature of a "popular" treatment of a subject of this description. The work of composing a paper, such as this was to be, was not to him a congenial task and he undertook it, as already stated, very unwillingly. He had his own ideas about insect-classification and they differed in many respects from the ordinarily accepted ones. Convinced of the correctness and reasonableness of these ideas he naturally incorporated them in what he wrote. His classification included some insects in genera containing, as constituted up to the present time, species with which they have little connection and, in one case, led him even to exclude a particular genus from a Sub-family one species of which has been regarded by the great majority of collectors in India as the type of that very Sub-family. This genus is *Melanitis* (the particular species referred to being *leda*) which he has removed from the Sub-family *Satyrinæ* and placed in that of *Nymphalinæ*.

In a matter of the present description individual opinions, opposed to generally accepted ones, are out of place and should be avoided.

The classification proposed to be adopted now will be the one followed in the past by Mr. Moore in his "Lepidoptera of Ceylon,''

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Plates I and II referred to in this article will appear in a subsequent number.

Owing to the author having changed the order it is impossible for the plates to appear in the order originally arranged. Plate D will therefore appear later on when the butterflies figured thereon are described.

Plate E is published now as the present article refers to the *Danainæ*.

EDITORS.

republishing the figures and the trouble of re-writing what does not require alteration.

The common butterflies of the plains of India are very few in number, probably altogether they do not exceed seventy species, though, of course, stragglers from the hills may add to the list. To make these papers more widely useful all insects will be mentioned that may possibly be found, even as stragglers, and also such as inhabit the hill-stations of the Bombay Presidency, *i.e.*, such as are found up to 4,000 feet above sea-level on the Western Ghats north of the great evergreen areas of the Kanara District. It is, after all,

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* Col. Bingham died in London after this paper was commenced. It is not yet settled who is to continue his work.

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(INCLUDING THOSE MET WITH IN HILL-STATIONS OF THE BOMBAY PRESIDENCY).

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In a matter of the present description individual opinions, opposed to generally accepted ones, are out of place and should be avoided.

The classification proposed to be adopted now will be the one followed in the past by Mr. Moore in his "Lepidoptera of Ceylon," by Messrs. Marshall and De Niceville in their only partially completed "Butterflies of India, Burmah and Ceylon," and, at the present day, by Colonel Bingham* in his "Butterflies" for the "Fauna of British India" Series, of which the first two volumes have lately appeared; it will be that of the last more particularly as the most recent authoritative work on the subject. It is considered advisable, however, to treat many of Colonel Bingham's Races as Species as has hitherto been the custom. This will simplify references as well as other matters.

It will, accordingly, be necessary to reject Mr. Young's key to the Suborder *Rhopalocera* (of the Order *Lepidoptera*: the other Suborder being *Heterocera* or Moths) as well as that to the Family of the *Nymphalidæ* already published, and restart the whole subject from the words "Butterflies are classed under......" on page 573 of Vol. XVI, Part 4 of the Journal. Reference will be made, where necessary, back to the plates and descriptions so as to avoid the expense of republishing the figures and the trouble of re-writing what does not require alteration.

The common butterflies of the plains of India are very few in number, probably altogether they do not exceed seventy species, though, of course, stragglers from the hills may add to the list. To make these papers more widely useful all insects will be mentioned that may possibly be found, even as stragglers, and also such as inhabit the hill-stations of the Bombay Presidency, *i.e.*, such as are found up to 4,000 feet above sea-level on the Western Ghats north of the great evergreen areas of the Kanara District. It is, after all, while on a holiday in the hill-stations that most collectors will find sufficient leisure to devote themselves to their hobby.

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* Col. Bingham died in London after this paper was commenced. It is not yet settled who is to continue his work.

Mr. Young wrote a supplementary paper to the present series entitled " First Hints on Collecting Butterflies ", which will be found at page 114 of Vol. XVII, Part 1 of this Journal, in which he tells how to catch, kill and set the insects in question. Further remarks may be of interest. The length of the net handle recommended by Mr. Young is that of an ordinary walking stick or less. It has been found, however, that it is best to have the handle as long as possible, and the net with as large an aperture as possible, say a 6′ handle and an aperture of 1·75′. The longer the handle and the larger the net opening, the greater is the chance of catching an insect. These large nets must be kept ready-made all in one piece (a bamboo handle and cane ring is best) and therein lies their disadvantage as few people like parading such instruments in the public thoroughfares. They are however by far the best nets and none of the trade nets come up to them in lightness. They can be made by a carpenter and *darzi* for a couple of rupees each. These large nets will be too big to use in undergrowth and confined spaces. A very handy instrument for this purpose may be manufactured out of an old badminton-racket by cutting away all the gut and attaching the muslin or leno bag. Equipped with two nets, a small and a large one of the above description, the collector will find himself ready for all emergencies.

The ordinary way of killing a butterfly is to pinch the thorax or chest between the finger and thumb firmly and gently while in the net : even the smallest and most delicate species can be disposed of in this way with practice and a little care. The best way of carrying the insects about in the field is to pin each one sideways, with the wings closed, into a cork-lined tin box which has been damped beforehand with water to prevent stiffness and desiccation from the dryness and heat of the Indian climate. The thinnest pins procurable should be used for this purpose; the boxes can be obtained at most of the " Universal Providers," such as the Army and Navy Stores or Treacher & Co. in Bombay. If an insect is not killed at once it will most infallibly flutter and damage itself before home is reached (Mr. Young recommends putting the small butterflies alive into chip pill-boxes. Do not !) If no tin box is to be had, the most efficacious way of keeping specimens is to " paper " them, *i. e.*, take an oblong piece of paper, not too thick nor yet too thin, fold it diagonally and symmetrically across, so that an equal single margin remains on each side, turn one of these margins over so as to make a triangular bag, drop the insect in head first, its body along the longest side, then close the open end of the bag by turning over the other margin also. Hundreds of these bags, each containing a butterfly, can be packed away in an empty cigarette tin without the smallest risk of damage, many may be stuck into the leather band inside a hat or even be put between the leaves of a pocket-book.

The easiest and most satisfactory way of manufacturing a killing-bottle is the following: Take a french prune bottle (or any other which is the same width all the way up), place some lumps of potassium cyanide (prussic acid) in the bottom, cover it over completely with a layer of cotton wool and put a circle of thickish cardboard paper over the whole of a size to fit the bottle firmly when pressed into place on top of the wool. Such a bottle is easily made and remade and sweats much less than the more expensive and troublesome plaster of Paris one. When the cardboard becomes too damp it can be replaced at once. It will become damp in time as the cyanide is somewhat deliquescent, absorbing moisture readily from the atmosphere, for which reason the bottle should not be left open; if it is, the fumes will also escape and the bottle become useless for the required purpose. An insect becomes very stiff if left for more than a few minutes in the bottle after it is dead but again becomes soft after 8 or 10 hours. "Skippers" are extremely difficult to set without damage if not quite soft. A slight pinching will often soften an apparently rigid insect so as to render it setable. Some collectors will probably prefer taking a killing-bottle with them in their rambles so as to be able to kill the captures without handling them and thus damaging them to some degree as killing by thorax-pressure is of course always liable to do. Such individuals will probably find it useful to have, in addition to the large bottle, several small tube killing-bottles to accommodate small "blues," and "skippers" as these will die more readily in a confined space and the smaller bottle is so much easier to handle. Tubes of 21mm. opening and about 60 mm. in length have been found the most convenient: they will fit into the ordinary cartridge pockets of a shikar coat. Such small killing bottles may be made in exactly the same way as the large ones and offer the additional advantage in the way of saving of trouble that the cut off end of the cork can be used to put over the cotton wool instead of a cardboard disc.

The German method of high setting for insects is the best and is recommended by Mr. Young. It is especially necessary in India where the enemies of collections are so numerous.

Coming to the breeding operations: the very young larvæ should never be handled; after they become well-grown they will take no harm from being touched gently: in the former case, when it is desirable to move the young caterpillar, it should be made to walk on to a leaf or twig of its foodplant by gently touching it behind with a feather or something soft. A larva that is quiescent preparing to cast its skin should never be touched or made to move until the process is complete; otherwise it will most assuredly die. Such a one may be known by the skin being pale, by its somewhat contracted appearance and particularly, by the neck being stretched tight, thin behind the head and gradually thickening backwards.

Leaves of foodplants wither quickly in the hot weather and in the cold weather (December—February) and should then never be gathered when the sun is up; they should be taken either before sunrise or after sunset when they will last fairly well. The twigs should be placed in water at once after picking. The food should be renewed at least once a day. Some caterpillars spin " nests " for themselves on particular leaves, *i.e.*, they cover a leaf over with a thick carpet of silk on which they lie. It is best not to disturb such larvæ but to cut off the leaves intact and pin them on to those of the new food.

Mr. Young had very little knowledge, except in so far as such is available in books and publications, of the life-histories of butterflies in this country and has, therefore, made little reference to the eggs, caterpillars or chrysalides. Yet it is certain that much of the interest attaching to insects is to be found, for the enquiring mind, in their habits and development, from the egg to the grub and onwards; and it is probable that most amateurs will desire to know something about these matters. Many will probably not know how to distinguish a butterfly from a moth, most will have very little idea what the earlier stages of either look like and nearly all will be unable to say with certainty whether any particular caterpillar belongs to one or the other of the two great divisions of the *Lepidoptera.* Instruction on these points will probably be of interest to most collectors.

The main difference between a butterfly and a moth lies in the antennæ or feelers which, in the former, are always more or less swollen into a "club," as it is called, at the extremities while in the latter they are, generally speaking, attenuated gradually to the end. In the former, also, these antennæ are always smooth while in the latter they may be set with hairs, simple or in fascicles, may have branches like a comb in a double or single row or may be toothed like a saw. The majority of the *Hesperidæ* or Skippers, a family of butterflies somewhat moth-like in appearance and habits, have the club ending in a more or less lengthened hook and are practically unique in this character. Some few moths have clubbed antennæ but may be recognised at once as such by the presence of an arrangement for attaching the hindwing to the forewing never present in any butterfly. This arrangement consists of what is called a "retinaculum"* and "frenulum" at the base of the wings on the underside. The retinaculum consists of, in the male, a single tuft of hairs, a bar, fold, or plate directed downwards from the costal vein, in the female of a tuft of hairs directed upwards from the median nervure or thereabouts. The frenulum consists in the male of a single strong, curved bristle proceeding upwards from the costal edge of the hindwing and

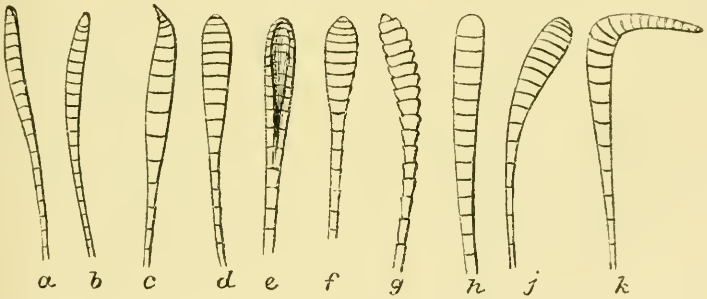

FIG. 1.—Antennæ of Butterflies (apical portions much enlarged). *a. Danais: b. Orsotriæna: c. Hypolimnas; d. Pareba; e. Libythea: f. Abisara: g. Papilio: h. Pieris: j. Lampides: k. Tagiades.*

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* Or "jugum." Col. Bingham informs us that a single aberrant Skipper from Australi possesses these attachments.

engaging under the retinaculum, or, in the female, of a double or multiple bristle or tuft of hairs always finer than in the other sex (*vide* Pl. II, figs. 42 and 42a). There are moths without these attachments but none of these have clubbed antennæ (*vide* figure 1).

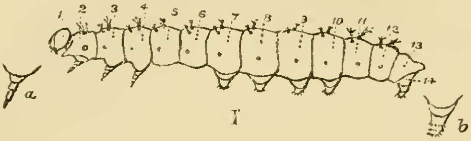

FIG. 2.—Larva (*Vanessa*). 1, head; 2—4, thoracic segments; 5—14, abdominal segments: *a*, true leg; *b*, proleg.

The butterfly larva may be worm-shaped or spindle-shaped or may have the appearance of a wood-louse (onisciform), this last form being confined to the family of Blues or *Lycænidæ* and being characteristic of it (*vide* Pl. II, figs. 21 to 28). They all possess a head armed with jaws and the usual mouth-pieces fitted for the mastication of vegetable substances and sometimes provided with horns, spines or tubercles. It is always connected with the body by a well-defined neck. The body is composed of 14 segments, including the head, which are, as a rule, plainly discernible with the exception of the last but one which is often rather obscure. These segments may be set with spines, isolated hairs or fleshy processes of various shapes. There are always three pairs of 3-jointed true legs (persisting in the butterfly) attached one pair to each of the three segments following the head: and five pairs of simple fleshy false legs, "pseudo-legs" or "prolegs," attached one pair to each of the segments 7, 8, 9, 10 and 14. These false legs are conical in shape ending each in a short cylindrical foot, the sole of which is set with minute hooks for holding on with: the anal pair (on segment 14) are called "claspers." All the segments from 2 to 13 are more or less broadly hoop-shaped, the 14th or anal segment being more or less conical, generally ending in a curve, sometimes finishing off square, sometimes running out into a pair of thin, pointed processes (*Satyrinæ* and *Elymniinæ*, *vide* Pl. I. figs. 1 and 2). Just above the base of the leg on segments 2 and 5 to 12 (in the corresponding position on the legless segments) there is a small, centrally situated oval surface, often of a different colour to the rest of the

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

EXPLANATION OF FIGURES 1, 2, and 3 ON PLATE III.

Fig. 1.—*Larva or caterpillar.*

1-14. the 14 segments.

1. head ; 2, 3, 4. the thoracic segments ; 5-13. the abdominal segments ; 14. the anal segment, the hinder part of which is called the anal flap.

15. three pairs of true legs.

16. four pairs of false legs (pseudo-legs or pro-legs).

17. spiracle of segment 6.

18. dorsal line of larva.
19. sub-dorsal line.
20. dorso-lateral line.
21. lateral line.

These lines, when broad, are called stripes or longitudinal bands.

Other lines occurring are called supra-spiracular, spiracular and sub-spiracular, according to their position with regard to the spiracles.

22. transverse band.

23. claspers or anal pro-legs.

24. dorso-ventral line, separating the back or dorsum from the belly or ventrum.

The black points on segments 2-14 show the positions of hairs or tentacles, etc., when present.

Fig. 2. *Head of larva* (front-view).

1. vertex or occiput ; 2. frons ; 3. cheeks ; 4. clypeus ; 5. labrum ; 6. mandibles ; 7. eyes ; 8. antennæ.

The halves of the head on each side of the central line are often alluded to as the lobes.

Fig. 3.—*Pupa or chrysalis.*

1-14. segments as detailed in fig. 1, but seg. 3 is always alluded to in the descriptions as the thorax.

15. eye.

16. palpus.

17. antenna or feeler.

18. upper wing or fore wing.

19. under wing or hind wing.

20. cremastral segment.

21. body band.

22. pads of silk on to which the cremastral segment or ends of the body band are fixed.

23. spiracle of segment 2.

24. spiracle of segment 8.

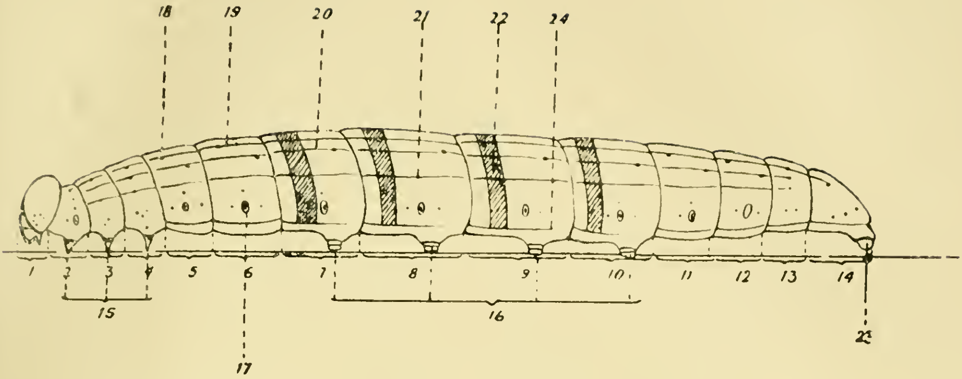
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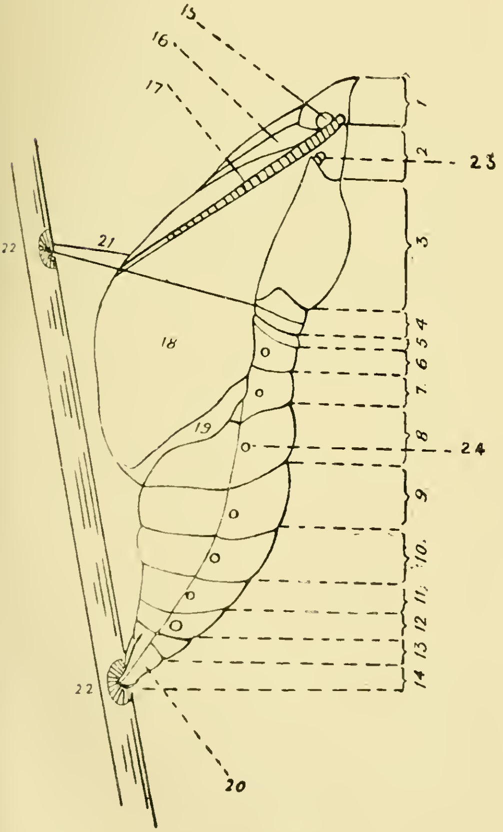
FIG. 1.—*Larva or Caterpillar.*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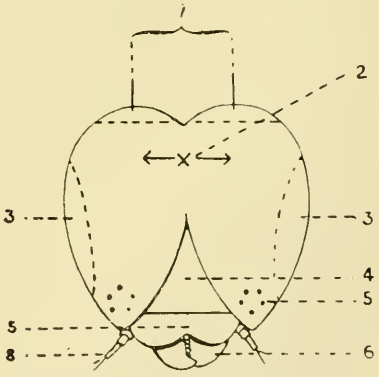
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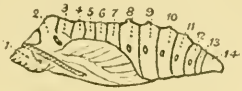
FIG. 2.—*Head of Larva* (front view).

FIG. 3.—*Pupa or Chrysalis.*

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

body, of a horny, consistency; these are the "spiracles" and form the openings to the breathing-tubes (*vide* figure 2).



II

Some butterfly larvæ (Pl. I, figs. 1—18; Pl. II, figs. 19—31) have the body destitute of hairs, others have few but never dense enough to hide the surface and the majority have a covering of hairs so minute as to be hardly visible to the unaided eye. Be it noted that we are talking of hairs and not spines: there are many spined larvæ. No butterfly larva has hairs arranged in tufts or pensils (*vide* Pl. II, fig. 36 or fig. 39) or dense enough to obscure the surface like those of numerous moths. The butterfly sub-family of the *Morphinæ* is unique in India in having caterpillars which might be called really hairy, being covered with fine erect hairs somewhat plentifully disposed all over the body, not all regularly placed; but even here the pattern of the skin is quite evident and they can be recognised for what they are by the distinct neck, the cylindrical pseudo-legs placed well under the body and straight, and the last segment ending in two well separated points (*vide* Pl. I, fig. 3). Many larvæ of the *Lycænidæ* (Blues) are covered with minute star-topped semi-transparent hairs, others have a fringe of simple ones along the ventrodorsal margin (Figs. 21—27 of Pl. I represent larvæ of this family): among the *Pieridæ* (Whites) the genus *Anaphæis* has a similar fringe, *Delias eucharis* (Pl. I, fig 17) has a few long whitish hairs all over the body, single, but arranged absolutely regularly four or five to each segmen sub-dorsally, dorso-laterally and some round the spiracles. Thus all larvæ with a furry covering and pencils and tufts of hair are moth larvæ, and there are many. On the other hand there are many butterfly caterpillars provided with spines, branched (*vide* Pl. I, figs. 11 and 10) and simple (Pl. I, fig. 9,) but very few such belonging to moths. Examples of spiny moth larvæ are few; contained in one section of the wood louse-shaped *Limacodidæ* (with pseudo-legs replaced by transverse folds of skin) with fleshy processes covered with irritant spines (Pl. II, fig. 40); the notodontid *Tarsolepes* possesses a caterpillar with long simple spines; there are few others. Fleshy processes are found in various butterfly caterpillars (*vide* Pl. I, figs. 7, 8, 13 ;Pl. II, figs. 25 and 27) but are rarer in those of moths. All butterfly caterpillars invariably show the same number of fully functional false legs, the five pairs ; those of moths may have one, two, three or four pairs wanting according to the division they belong to ; or even be without any : or may have one or two pairs reduced in size and only partially functional ; in the moths, also, the feet or extremity of the false legs or pseudo legs is very often triangularly dilated at the end and the anal claspers are held stretched out behind, and have the basal fleshy part often broad and flattened ; the head too is often covered slightly by the margin of the 2nd segment, *i.e.* there is no distinct neck characteristic of the great majority of them (*vide* Pl. I and II).

From all this it would seem that the larvæ of the two sections are not easily distinguishable but, as a matter of fact, in practice, it is not difficult to separate them with absolute certainty once a little experience is gained.

All butterfly caterpillars are vegetable feeders with one or two exceptions among the *Lycœnidœ* where a few species batten upon *Coccidœ* or scale-insects. Most larvæ confine themselves to one particular food-plant, refusing all others : some will eat nearly allied species also, others again have apparently a wide range of taste and affected many different kinds. Certain species are addicted to cannibalism and will, especially in default of sufficient vegetable food, not hesitate to make a meal of a brother or sister that may be conveniently handy at the time, *i.e.* that may be unable to move for such reasons as being in the quiescent state preceding a moult or change to pupa, or that may be in the fresh skin of the succeeding chrysalis. This is particularly the case with many *Lycœnidœ* and some of the *Danainœ* and *Pieridœ.* Cannibalism is supposed generally not to agree with the larvæ practising it, but this theory can be relegated to the same boat with that which ascribes a hairless skin and general debility to man-eating tigers and panthers.

The butterfly egg may be longly oval, spherical, domeshaped or turban-shaped according to the family, and the surface is often very beautifully sculptured. The number laid by any one insect varies greatly according to species, some laying many, others few. The mother-butterfly is very particular as to where it lays and will examine many shoots, flowers, twigs or whatever it is, very carefully, before depositing its treasure which is then, however, left to look after itself. It is a common thing to see a nymphalid butterfly hammering a leaf with its semi-aborted forelegs before laying, presumably to frighten inimical spiders or other foes away. In some cases, probably for greater safety, the eggs are laid on a tendril, dead bit of grass, twig or wood in the neighbourhood of the food, but not on it. In due time, generally in a sub-multiple of seven days under normal conditions, the young larva eats its way out through, and makes the first meal of, the shell, before taking its subsequent food. In the course of its life it grows and casts its skin five times (this is called moulting), becoming quiescent for a short period previous to each change on a bed of silk woven expressly for the purpose on the surface of a leaf or other such place. In moulting, the head is cast entire (except in the last change to pupa or chrysalis when it splits down the middle); the skin bursts down the middle line of the back or dorsum in segments 2, 3, 4, and the new caterpillar walks out gently and very gradually as a soft, delicate reproduction of the original grub, somewhat larger in size each time. It is often provided with a new pattern of coat, sometimes it is even without the spines it may have possessed in the preceding stage, though this last only applies to the earlier changes for the last two are strictly limited to an increase in size. The cast skin is generally eaten while still soft though some species seem to omit this.

When a larva is full fed, that is, when it is full grown, it becomes very active for a time and may wander for a long distance before reaching the place where it chooses to turn into the pupa. It generally changes colour somewhat during this time, the pattern of the skin, if present, fades and the bright colours become dull. The final resting place choosen, it settles down, spins a small pad of silk (effected by means of tho " spinneret," a small protruberance at the base of the mouth communicating inside the body with a pair of tubes or glands containing the viscous fluid silk) by moving the head backwards and forwards and from side to side, turns round, grasps the pad with the anal claspers, fixing their hooklets well in and remains quiescent for a period varying from some hours to a full day or more according to circumstances. The skin becomes more and more transparent, the larva makes wave-like, swelling motions from the tail end forwards, then jerks itself from side to side at intervals and splits down the centre of the head and along the back of segments 2 to 4, the pupa emerging slowly and gradually through the opening. The whole skin is worked down to the tail by the same wave-like, swelling motions and the "cremaster" or tail of the chrysalis is disengaged from it, lifted over it and fixed into the pad of silk by a screwing motion which works the cast covering, now in the shape of a ball, out sideways. The freshly emerged pupa is very soft, more or less colourless and nearly as long as the larva was, but soon becomes hard, shrinking in length, gaining thereby a little in breadth and the colour gradually develops. Some pupæ are suspended by the tail only, hanging thus head downwards (*Nymphalidæ, vide* Pl. I, figs. 1, 2*a*, 3*a*, 4*a*, 5*a*, 6*a*, 7*a*, 8*a*, 9*a*, 10*a*, 11*a*), others lie back against a silken band or loop prepared beforehand by the larva for its own body and rest, thus slanting in a semi-upright position (*Papilionidæ* and *Pieridæ, vide* Pl. I, figs. 13*a*, 14*a*, 15*a*, 16*a* and 17*a*, 18*a* ; Pl. II, 19*a*, 20*a*), the loop being attached to the same surface as the tail ; others again lie on the ground or on a leaf, being fixed or not by a closely-applied body-band or loop as well as by the tail (*Lycænidæ, vide* Pl. II, figs. 21*a* to 28*a*) or are enclosed partially or completely in a cylindrical or semi-cylindrical cell made of a leaf of the food-plant, green or dry, on the tree or fallen (*Hesperidæ, vide* Pl. II, fig. 31*a*). These last are always attached by the tail as well as by a closely applied loop or body-band.

Some few caterpillars lie, after reaching their full growth, for variable periods quiescent, taking no food for weeks and perhaps months, then pupate as usual and produce the butterfly after the normal period. This has been observed in the case of *Tagiades atticus* and a few others. The time spent in the pupal stage varies generally according to the time of year, being shorter in the monsoon than in the dry season or cold weather. Some few species of butterflies have only one or two broods in the twelve month, while the vast majority breed more or less all the year round, the time of greatest activity in this respect being that of the sprouting of the leaves : April-May and September-October. The matter of the number of broods seem to depend really altogether on the food-plant, if it is one that produces young leaves only once in the year and at a particular season, the butterfly whose larva feeds on those young leaves will be found only at that time ; if it has eatable leaves all the year round, and, if the caterpillar will feed upon other than young leaves also, then the butterfly will have broods following each other without intermission, though the time between any two will always be shortest when the leaves are young and fresh. The growth of larvæ is slowest in the cold weather when the leaves are hardest. The slower the growth, always given plentiful food, the larger the resulting butterfly. In the one and two brooded butterflies it is the pupal state in which the longest time is spent, this time amounting in certain species to as much as eleven and twelve months in rare cases. Heat and cold, rain and drought, each has its effect on the duration of this stage. A larva, fed upon young succulent shoots, grows rapidly and the resulting imago (perfect insect) is rather small and dark-coloured. The growth of such larvæ is so rapid indeed that the whole time elapsing between the appearance of the egg and the birth of the butterfly may be but a short fortnight as in *Atella* and *Appias*. The pupal stage is then, of course, of short duration. The eclosion of the butterfly takes place by the splitting of the pupal case along the same line as that of the larva at the end of its last stage ; the emergence being effected slowly and gradually as usual. The newly-born insect holds on by the fully formed legs to the empty case as a very general rule or it may run away to some convenient place where it can hang in a position to develop its wings without interfering with their free expansion. The wings, all shrivelled and wrinkled at first, though perfectly symmetrically so, gradually unfold and assume the flat, fully expanded aspect they finally have, hanging straight downwards ; soft at first, they gradually harden in the air and the process is aided by their being opened and exposed on all sides as they gain strength. In half an hour or so everything is ready and the butterfly enters upon its real life by flying off into the sunny world, there to fulfil its appointed task. Although the colours are fully developed before eclosion from the pupa, sunlight and motion are necessary to the full realisation of the brilliant tints distinguishing many species, life being a *sine qua non* : for, if death intervene too soon, the colours remain for ever dull.

Every species of butterfly has its own particular character resulting in habits of life distinct from any other. Some delight in the company of their kind, some are solitary and choose to be alone ; some delight in sunlight, others affect the shade, one likes the dry climate of the Deccan, another prefers the damp, warm, close valleys of the Konkan hills ; some are addicted to strong drink, frequenting the toddy-pots hung on the palms and the fermenting juices exuding from the trunks and branches of trees ; others again have a predilection for high game and will sit with evident enjoyment on a rotten carcase or other objectionable substance, imbibing nourishment therefrom : and these are rarely, if ever, found at flowers. Many of the scarcer species bask on the tops of high trees and descend but rarely to ground level, while a large number never seem to rise above a few feet. Some species migrate long distances in a given direction at certain times of the year in great numbers together though it is difficult to assign any definite reason for their doing so : some hardly ever go outside an extremely limited area. Other habits will be alluded to, as far as they are known, in their proper place under the description of the genera and species.

Caterpillars have many enemies. Insects of various kinds lay their eggs in them, or on them producing larvæ or grubs which feed on the fatty parts of their bodies, carefully avoiding the vital organs, grow and turn to pupæ inside the caterpillar (*Ichneumonidæ*), come out and pupate on the surface of the body, spinning little cocoons of a white cottony substance (Chalcid Wasps), fall to the ground and change there (*Diptera* or Flies) : others suck them dry (*Hemiptera* or Bugs : chiefly *Reduviidæ*) ; while the Mason Wasps (*Eumenidæ*) and other *Hymenoptera* sting them and carry them off to their nests as a food-supply for their young ; the ordinary Wasp (*Vespidæ*) masticates them to prepare a fitting nourishment for its grubs. Spiders destroy numbers for food, ants do not disdain them, lizards will demolish whole batches at a sitting, birds and frogs, toads, snakes, some species of beetles—all are enemies of the wretched caterpillar : intestinal worms and different kinds of fungus also play a considerable part in diminishing their numbers.

Even the eggs of butterflies are not exempt from insect enemies. The worst of these are the parasitic *Microichneumonidæ*, small *Hymenoptera* of many species which lay their eggs in those of the insects in question, the resulting grubs, sometimes several to a single egg, feeding on the interior, undergoing transformation therein and finally eating their way out through the shell as perfect wasps.

Pupæ are not, as a rule, attacked by parasitic insects though *Ichneumon* wasps of the larger kinds and Tachinid flies come to maturity within them, the larval stage having been passed in the preceding caterpillar stage. This immunity of the pupa may be ascribed partly to the possession of stridulating organs which produce a hissing sound and frighten enemies, partly it is undoubtedly due to the integument being fairly hard and tough; also to protective shape and colouring: though these two factors probably count for very little against purely insect agression. The organs which produce sounds are situated on the abdominal segments 8 to 11 which are capable of being rubbed against each other along the margins by a side to side motion of the body. All chrysalides that are formed in the open, *i.e.*. that are not hidden in any way from view, are subject to colour variation according to surrounding circumstances, the pattern often being determined by the shape of neighbouring objects as regards the distribution of the colours. Those, that are formed in crevices, holes, under stones and clods of earth or that have specially prepared leaf-cells to protect them, are not subject to this variation being, presumably, otherwise sufficiently safeguarded. The fresh pupal skin as well as the larval skin must be extremely sensitive to the effects of light, as the colours of surrounding objects invariably produce results on one and the other which are none the less surprising in that they are necessarily confined within fairly narrow limits.

Many lycænid larvæ are attended by ants of different species for the sake of a sweet juice secreted by them. The ants take great care of them, occasionally building temporary sheds over them for protection and, in the case of certain species, rarely quitting them. Other species attend the caterpillars only from time to time: or perhaps it would be more correct to say that certain species of caterpillars are attended by ants only from time to time: for the attraction seems to be stronger in some larvæ than in others. The sweet juice is excreted by a gland situated in the centre of the back, on segment 11, which is rather like a mouth in shape. The ants stroke the hinder part of the body of the caterpillars gently with their antennæ which has the effect of making the gland exude a drop of liquid which is lapped up greedily. On segment 12, just above the spiracle on either side, there is generally a circular opening from which can be everted a white cylinder of a certain length, set round the top with minute hairs, the use of which it is difficult to guess if they do not serve for signals to the ants. These organs, curiously enough, are permanently exserted in *Curetis* (*vide* Pl.II. fig. 28) where they undoubtedly serve to frighten enemies: for the larva can, at will, push out of the top of the cylinder, a long bunch of soft hairs which it whirls around rapidly several times when alarmed or irritated and then withdraws. Ants recognise the source of the sweet juice so well that they attend not only the larva but also the egg, pupa and imago of the species yielding it. They will keep the larvæ in their nests to which they guide them ; and these often turn to pupæ in the nests. It is not a very uncommon sight to see ants escorting a newly-born butterfly to a spot where it can develop its wings in safety and comfort. While it is probably true that most larvæ have acquired the habit of secreting the juice for the sake of the occasional protection the presence of ants affords them—for undoubtedly it is a protection—and can quite well live without the attentions of these insects, yet it is an undoubted fact that certain species require these attentions and will not live in health in their absence ; so much so indeed that the first requisite seems to be the presence of their protectors : and this may explain the fact that such larvæ have various foodplants, often botanically widely separated. *Tarucus*, *Arhopala*, *Surendra*, *Zesius*, *Aphnœus* are some of the genera whose larvæ are always attended by ants ; *Neopithecops*, *Castalius* (*ananda* always), *Lycœnesthes*, *Polyommatus*, *Lampides*, more intermittently ; *Cheritra*, *Camena*, *Curetis* and nearly all *Rapala* not at all or hardly ever.

While on this subject of protection it may be of interest to mention that all the caterpillars of the Swallowtails (some of which by the way have no tails) have the power of throwing out two long conical processes, variously coloured red, blue, orange, according to the species, from the back of the neck just behind the head. These emit a rather pungent, somewhat peculiar odour of lemon or lime-fruit, due no doubt to the essential juices of the foodplant which is, with few exceptions, belonging to the botanical families *Rutaceæ*, *Anonaceæ* or *Loranthaceæ*, all of an aromatic nature. These organs are really one, called an *Osmeterium*, being joined at their base into a single stem ; they are stowed away by being withdrawn inside themselves and into the main stem. Their sudden protrusion is probably often sufficient to frighten intending aggressors, such as the *Ichneumon* wasps and the extreme pungency of the odour must have a considerably deterrent effect upon small enemies. The larva, when disturbed, will throw its head back suddenly and bring the two organs into contact with any exposed portion of its body, so that an attacker would be liable to be touched by their somewhat glutinous surface with unpleasant result.

The stinging irritant hairs of some moth caterpillars are very well known to most residents in India from painful personal experience. No butterfly larva possesses these though, as already pointed out, many of them have an armature of spines, branched or simple, disposed all over the surface of their bodies. What the particular use of these spines is, cannot be said with certainty ; they are not irritant and the only explanation that can be offered is that they serve for protection against inimical attack to some extent, for it is certain that such larvæ, when touched, throw the head over the back, bringing the tail end to meet it, thereby protecting the body by an impenetrable network of spines bristling with sharp points which it would puzzle any fly or wasp to get through. *Junonia*, *Hypolimnas*, *Kallima* and their relations have these branched spines. *Charaxes* (*vide* Pl. I. fig. 4.) larvæ, otherwise naked, have long horns on the head like those of a bison with which they can sweep the whole length of their backs and do so viciously when touched. The larva of *Neptis* seeks protection by lying hidden amongst leaflets which it detaches together with part of the midrib of the *Acacia* leaves it feeds on, fastening each part on with silk to prevent it dropping to the ground ; the leaflets soon wither, become dry and look incapable of supporting insect life of any kind (curiously enough *N. viraja* actually eats these leaflets until they become too hard) and consequently are presumably unattractive to the predacious spider, the great enemy of all small larvæ. *Moduza procris* and the *Athyma* butterflies eat away the point of the leaf only leaving the midrib at the extreme end of which the little larva sits, throwing up a rampart behind it, along the eaten edge, of the refuse of the meals which have passed through its body cemented together with silk from the spinneret and, often, even prolongs the midrib by adding little particles of the same substance placed end to end. Life on the midrib is continued up to the third or fourth stage during which the colour of the larva is more or less that of the refuse : a non-descript earthy red-brown. The last stage is brighter, often green in colour with whitish bands and the grub wanders about, resting generally quite openly in the middle of any leaf that comes handy.

The young stages of many *Papilio* larvæ much resemble the droppings of birds being coloured brownish or greenish grey with a white patch in the middle (*polymnestor*, *daksha*, *polytes*, &c.), and all these are naked from the first though they have the *osmeteria* alluded to above ; some others of the same genus are provided with several pairs of very much branched spines which completely disappear before the last stages are reached (*teredon*, *eurypylus*) ; in the *Ornithoptera* group (*minos*, *hector*, *aristolochiæ*) the larva smells disagreeably : which seems to be sufficient protection.

As may be supposed the perfect insect or butterfly does not need the protection from parasitic insect enemies that is so necessary to the earlier stages. Its chief enemies are birds and lizards, the former when flying, the latter when resting : and, to a lesser degree, the spiders which spin their webs across paths and clearings to entrap the unwary flier hastening along on rapid wing in pursuit of the brief pleasures of its short aërial life. Bee-eaters (*Meropidæ*), and Kingcrows (*Dicruridæ*) are the chief bird enemies. They catch the butterflies on the wing accounting for a goodly number every day : swallow-tails and " whites " being the ordinary victims, even the large *polymnestor* not escaping occasional capture. The fast flying *Nymphalinæ* are not easily caught, the weaker *Satyrinæ* live nearly altogether in the shade, amongst tall grasses and in bushes and forests and so escape death to a great degree, the " blues " are extremely rapid in their movements or are too small to offer much temptation as food to birds and are, therefore, less victimised than many others ; the " skippers " are also among the favoured in this respect. But what about the slow flying, weak-winged *Danainæ* which should be the most easily caught of all ? They fly composedly from place to place, never in a hurry, courting the sunshine and open spaces as if they had nought to fear from aërial enemies. And this, in truth, is practically the case. They are all, without exception, unfit for food and the birds know it. They taste nasty and are difficult to kill being provided with disagreeably smelling glands and hairs which assuredly also taste bad and a body more like India-rubber than anything else in its power of resisting pressure. Try and kill one of these insects by the ordinary thorax-pressure sufficient for the ordinary butterfly: ten to one it will, after lying seemingly dead in the hand, suddenly take to its wings and leave in a hurry. Besides the faculty of resistance to pressure, these insects possess the extra trick of shamming death when in a tight place and this must be extremely useful to them in view of the undoubted objection all predatory animals have (birds included) of quitting hold of anything with life in it; for, of course, birds occasionally make mistakes and catch an undesirable Danaine now and then even though they will not eat it. As mentioned already above, the *Ornithoptera* group amongst the *Papilionidæ* are also protected by this quality of tasting bad. Birds will not eat them, neither will lizards willingly or readily, and this immunity is so useful that another species of the same Family, not possessing the attribute, has arrived at a more or less serviceable imitation of *P. hector* and *P. aristolochiæ* in colour and pattern. This other species is *P. polytes.* How the imitation has been effected we do not know: the fact remains that the resemblance exists and that it is useful for the safety of the species may be assumed. In this case the females of *P. polytes* are only thus favoured, there being two distinct protected forms, one resembling *P. hector*, the other *P. aristolochiæ*; still a third form resembles its own male which has a completely different aspect to the protected forms, being plain black with a white band of spots across the hindwing continued as a border along the outer margin of the forewing. In the Bombay Presidency where all three species are equally common, the imitating forms of *polytes* are the common ones while the form like the male is very scarce, in other parts of India where the ornithopterine species are uncommon, these forms are also scarce and the non-imitating one is most frequently met with. There are a goodly number of species among the *Papiliones*, other than the one mentioned, which are imitators also, but imitators of the various forms of *Danainæ*, not of members of their own genus.

Lizards are more destructive to larvæ than to the winged insects as it is only natural to suppose. However, they take considerable toll of certain species of butterflies, chiefly of such as spend much of their time sitting on the ground, tree-trunks and other places affected by these reptiles. So it happens that the *Satyrinæ* are the most heavily victimised of all because of their sedentary habits in corners and amongst leaves and rubbish on the ground. It is not uncommon, however, to see a lizard with its sharp eyes and intimate knowledge of the ways of its prey completely nonplussed by a *Melanitis*; it has been seen to settle among dead leaves, the protective colouring above alluded to blending so admirably with surroundings as to render detection even at its hands impossible. Once among the sand hillocks blown up by the wind in a desert in Sind, a somewhat inferno-like paradise of fossorial wasps, ants and certain other sun-loving insects besides various sorts of lizards, one of the last, most nimble of its kinds, was seen to start in pursuit of a Painted Lady (*Vanessa cardui*) that happened just at that moment to fly over its head well up in the air. The butterfly disappeared over a sand-hillock but not quickly enough to keep out of sight of the lizard which, on first spying the passing form against the clear sky, had set off in hot chase from under a shady Heliotrope on a sandy slope down into a hollow and up on to the crest of an adjacent mound : whence, so great was the impetus, it took a flying leap of some two or three feet out into the air, landing very nearly at the same time as the butterfly and close to it on a flat piece of baked soil below. Without a moment's delay, in fact all in the same breath so to speak, it had pounced on and seized the insect before it had hardly time to close its wings. From which it would seem that lizards are enemies not to be despised even by the strongest winged and most restless of our butterflies. The particular lizard referred to is *Agama isolepis*, Bouleng.

Flies (*Diptera*) and Dragonflies (*Neuroptera-Odonata*) must also be reckoned amongst the enemies of the butterfly. Amongst the former there is one predaceous group which must account for many deaths, namely: the Robber-flies or *Asilidæ*. One single specimen, perched upon a twig of vantage in this same Sind desert, was observed to catch and eat, in the space of an hour or so, no less than half a dozen small Lycænids of the species *Chilades trochilus*. Dragonflies, in the same place, were seen hawking and eating the same little butterfly which swarmed there in great numbers, where the semi-creeping *Indigofera* with its bright red spikes of flowers offers an abundant food for the larvæ with ants galore to protect them and keep them in health: which does not, however, prevent them from being carried off in large numbers by *Ammophila* wasps wherewith to stock the 3″ to 6″ perpendicular shafts in the hard soil at the bottom of which the young wasp-grub lies with its nose buried in the store of delicate green food.

It is probable that the disagreeable smell emitted by the ornithopterine and danaine groups of butterflies, while disagreeable to enemies, is attractive to the insects themselves and serves to bring the sexes together. The males of many species of *Lepidoptera* have glands, patches of scales, tufts of hair, which can have but this *raison d'être.* Many of the *Lycænidæ* and *Satyrinæ* possess patches of specialised scales in the males which emit odours, called *androconia. Discophora lepida* (*Morphinæ*) male has a large circular patch on the centre of the upperside of the hindwing which smells of apples and lemons mixed so strongly as to be plainly discernible even to the human nose from a distance of many yards ; indeed the smell alone is sufficient to betray the presence of the butterfly, otherwise difficult to find or see from its habit of coming out only after sun-down and in dense bamboo-jungle. It has been observed that the females come to meet the males where the latter, in the dusk of the evening, have the habit of flying backwards and forwards, to and fro, as long as any light lasts—and perhaps after—in one particular glade amongst the bamboos.

Some butterflies bear a striking resemblance to the natural objects among which they are in the habit of resting, this resemblance enabling the species possessing it to escape their enemies in many cases. It is found in all classes of insects here and there but in none, perhaps, is it so perfectly developed as in the well-known—at least in name—" leaf-butterfly " belonging to the genus *Kallima* of the sub-family *Nymphalinæ.* These insects are in the habit of settling, head downwards with the wings closed over the back so as to show only the undersides, on a tree trunk, twig, thin stem or dead leaf in shady places in the undergrowth in the jungle and it is often, although the eyes may have actually watched an insect to its resting place, extremely difficult to distinguish it from the surrounding leaves hung up in cobwebs, caught in the axils of twigs or branches of plants, &c., so astonishing is the resemblance to a dead leaf by reason of the wonderful shading of both wings with the dark line running up the middle by way of midrib and the production of the fore and hind wing at the apex and anal angle to represent the point and stalk, respectively. No two specimens of *Kallima* are exactly alike in the colouring or even pattern of the underside and they are dark and ocellated (with ring-spots) in the wet season, much lighter with clearer markings and without ocellations in the dry season when the points to the wings are also much more accentuated. In the wet season, the time of the presence of many forms of grey fungus on the damp dark leaves, the wings are often marked with chalky grey rings for all the world like the fungus in question. In *Melanitis* of the *Satyrinæ* which settles on the ground amongst dead leaves, often lying sideways with closed wings, the marking is so varied to resemble the surroundings that it is difficult to spot an insect once at rest ; in these also no two individuals are exactly alike and the production of the wings is exaggerated in the cold weather. The wet-season forms of many of the satyrine butterflies are so different from the dry-season ones that some of them were for a long time classed as distinct species. *Melanitis leda* was the dry-season form. *M. ismene* the rains form for example. All the nymphaline *Junonia* butterflies, too, show a tendency towards a dry-season accentuation of the wings and simplification of the markings of the underside; more particularly is this expressed in *J. almana* which, in the dry weather, has the underside coloured to resemble a dead leaf, the rains form being heavily ocellated ; and these two forms were formerly considered to be distinct species : *J. almana* and *J. asterie*, respectively. Seasonal variation as regards colour and pattern is a common phenomenon among butterflies and many species have, in this way, two well-recognised forms, the wet and dry season ones so-called, showing itself in the former in a more or less important development of black colouration in some cases, in the appearance of dark patches on the underside in others, in difference of shading and even, as above mentioned, in a change in the outline of the wings. The quicker growing monsoon-forms are small and dark, the slower growing dry weather forms are large and lighter—always of course presupposing a plentiful supply of food in both cases. Starved individuals are naturally small, and generally light in colour and markings, when usual, tend to disappear.

Sufficient has now been said in the way of Introduction. Below will be found the keys to the families, sub-families, genera and species dealt with in these papers. These keys have been formed as much as possible on well defined and clearly visible qualities of shape, marking and colouration and as little recourse as possible has been had to the more obscure characters of venation of the wings, form of legs, sexual characters, &c. It has been found unavoidable altogether to steer clear of them, however, in several cases and it is feared that this may offer difficulties to the uninitiated. Any way, it cannot be helped and it is hoped that, with the use of benzine and a good lens, combined with patience, these difficulties may not prove unsurmountable. The best form of lens for the examination of the wing-veins, &c., is a "Coddington" which can be purchased for a few rupees and is small and portable.

The Plates are three-colour prints from original handpaintings by Mr. Horace Knight which are perfection itself if we except the shade of *Papilio daksha* ♀—it is not dark enough and was probably taken from a somewhat faded specimen—and *Catochrysops strabo* where the small subcostal spot beyond the discocellulars on the underside of the forewing has been omitted. The shade of the prints is always somewhat too dull and they in no case do justice to the originals in purity of colour and clearness, although this in no way interferes with the fact that the insects figured cannot be mistaken for anything but what they are: which is all that is required. The light blue colour, particularly, always comes out too dark in the prints. The wood-cuts are nearly all reproductions of those used by Colonel Bingham in his work and the blocks were kindly lent to the Society by the courtesy of the Secretary of State for India.

Most of the descriptions of the imagines or perfect insects are taken from Colonel Bingham's work, as far as available.

Butterflies are classed under the following six families in India. Those treated of in these papers are representative of all six. Colonel Bingham's key to the families is as under:—

A. Antennæ close together at base; hind tibiæ with only a terminal pair of spurs; one or more veins

in the forewing forked or coincident beyond the cell.
- *a*. Precostal nervure of hindwing present.
    - a^1. Front pair of legs imperfect in one or both sexes.
        - a^2. Front pair of legs imperfect in both sexes... **Nymphalidæ.**
        - b^2. Front pair of legs imperfect in male, perfect in female.................................. **Nemeobidæ.**
    - b^1. Front pair of legs perfect in both sexes.
        - a^2. Vein 1*a* in hindwing wanting, claws simple. **Papilionidæ.**
        - b^2. Vein 1*a* in hindwing present, claws bifid.... **Pieridæ.**
- *b*. Precostal nervure in hindwing absent............... **Lycænidæ.**

B. Antennæ wide apart at base ; hind tibiæ generally with a medial as well as a terminal pair of spurs ; all the veins in the forewing from base or from cell, none forked or coincident beyond.. **Hesperiidæ.**

As a matter of fact the above six divisions will offer very little difficulty, for the insects composing them are of widely different facies or appearance. The *Hesperiidæ* or Skippers can be placed at once by the peculiar shape of their antennæ with few exceptions ; a glance at Plates M. and N. probably will suffice to show that they differ in general appearance from all other butterflies. The very characteristic markings of the underside of the wings in the *Lycænidæ* or Blues will separate them off from the other families, although the colour and facies is, as a rule, sufficient for that purpose. Plates G. and H. will prove this. The *Nymphalidæ* can at once be recognised by the character given in the key of imperfect legs in both sexes ; they are the only butterflies that possess it. The *Nemeobidæ* will offer no difficulty as the family is represented by only a single species of a single genus coming within the scope of these papers : it is *Abisara echerius*, Stoll. and is depicted on Plate F., figs. 40 and 40*a*. The remaining two families, the Swallowtails and Whites (*Papilionidæ* and *Pieridæ*) have the legs all perfect and are thus separated from the *Nymphalidæ* ; nobody could for a moment mistake one of them for a Blue or a Skipper. In these papers there are only two Swallowtails, the ground-colour of which is white and both have long narrow tails ; the ground-colour of nearly all Whites, on the contrary, is white and none have tails: some of them are white with orange tips to the forewings, a few are salmon-pink ; all have black borders; the wet-season forms of some are nearly completely suffused with black (*vide* fig. 3).

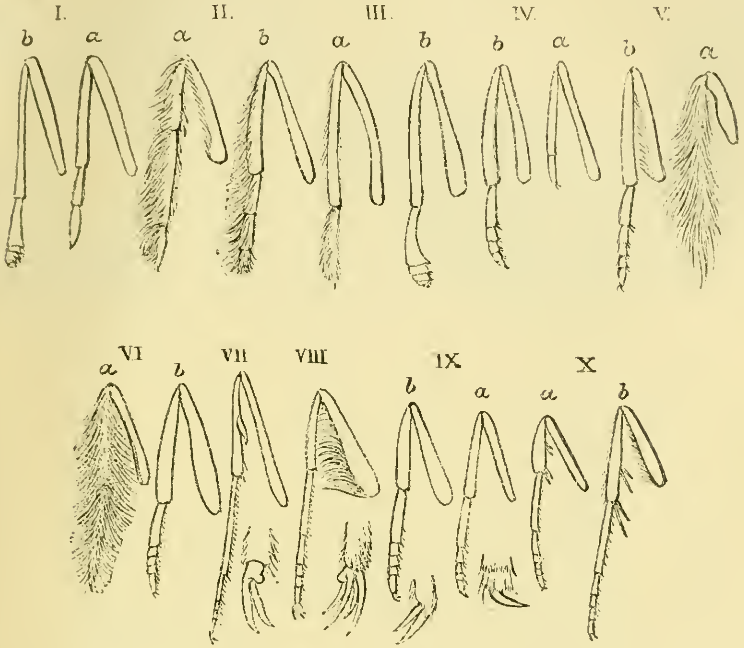


FIG. 3.—Fore legs, *a* ♂, *b* ♀, of I, *Hestia* (*Danainae*); II, *Mycalesis* (*Satyrinæ*); III, *ynthia* (*Nymphalinae*); IV, *Pareba* (*Acræinæ*); V, *Libythea*; VI, *Abisara* (*Nemeobidae*); VII, *Papilio* (*Papillionidae*), claws simple (♂. tibiæ with pad on inner side); VIII, *Pieris* (*Pieridae*), claws bifid; IX, *Lampides* (*Lycaenida*), ♂ tarsus imperfect with only one claw; X, *Tagiades* (*Hesperiidae*), tibiæ with a medial as well as an apical pair of spurs.

A word or two on the use of the keys may be necessary. When an insect is to be determined, the first thing is to fix the family it belongs to by the above key. That done turn up the key to the sub-families or genera composing that family; after that proceed to the key to the species. To work any particular key look under A, B, . . . until one of them fits the butterfly, then go to a, b, c, . . . until one of these answers, then to a^1, b^1, c^1, . . . , then to a^2, b_2, c^2, . . . , then a^3, b^3, c^3, . . . and so on until the species is arrived at.

FAMILY—NYMPHALIDÆ.

This family is divided into six subfamilies distinguished in the following key.

A. Discoidal cell in fore and hindwing closed.

a. Vein 1 in forewing forked at base (*Vide* fig. 4.) *Danainæ.*

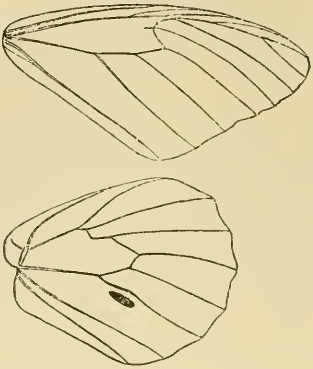


FIG. 4.—Sex-mark form 1 on hind wing, and neuration: *Danais chrysippus.*

b. Vein 1 in forewing not forked at base.
  a^1. Palpi more or less erect or only obliquely subporrect, not remarkably long, not forming a beak.
    a^2 Palpi strongly compressed; eyes often hairy, one or more veins in forewing generally swollen at base; wings generally short and broad, hindwing often dentate or caudate.. *Satyrinæ.*
    b^1. Palpi not compressed, short cylindrical, slightly clavate; eyes never hairy; veins never swollen; wings always long; hindwing never dentate or caudate .... *Acræinæ.*
  b^1. Palpi porrect, projecting, remarkably long, nearly as long as thorax, forming a beak pressed close together (*Vide* fig. 5.)......... *Libytheinæ.*

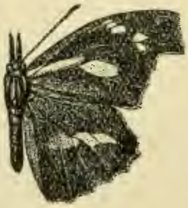
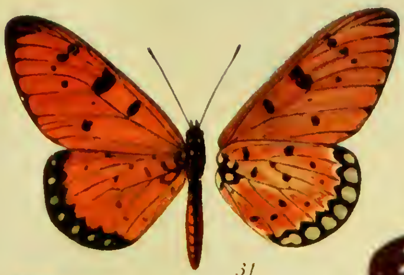


FIG. 5.—*Libythea myrrha*, ♂. $\frac{1}{1}$.

B. Discocellular cell open or, if closed, lower discocellular very slender, inconspicuous.
  a. Palpi small, narrow, sharp in front...... .... *Morphinæ.*
  b. Palpi large, broad, rounded in front .... *Nymphalinæ.*



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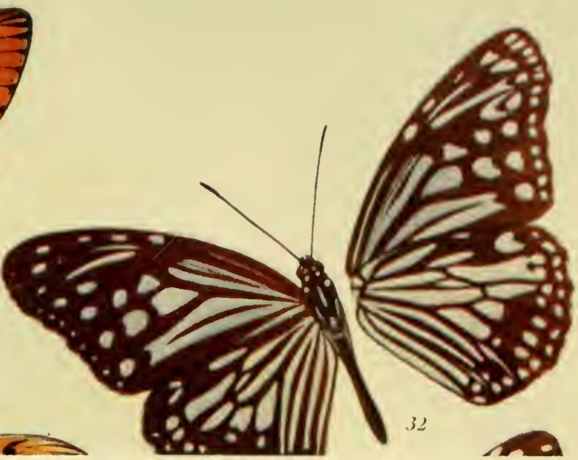

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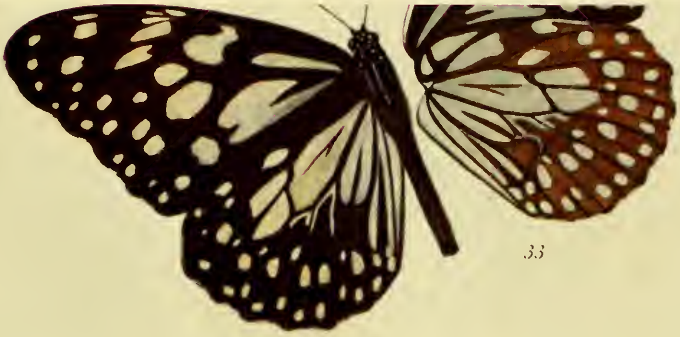
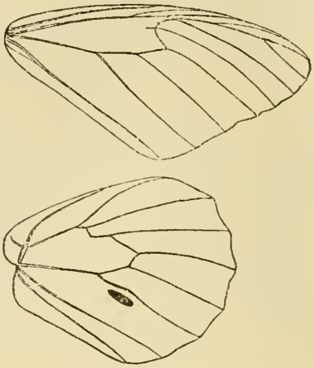


33

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. Hentschel-Colourtype *a.* Vein 1 in forewing forked at base (*Vide* fig. 4.) *Danainæ.*



THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Description of Plate E.

Fig. 31.	*Telchinia violæ*, ♂.
,, 31*a*.	,, ,, ♀.
,, 32.	*Danais aglea*, ♂.
,, 33.	,, *limniace*, ♂.
,, 34.	,, *chrysippus*, ♂.
,, 35.	*Euplœa core*, ♂.

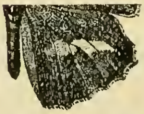
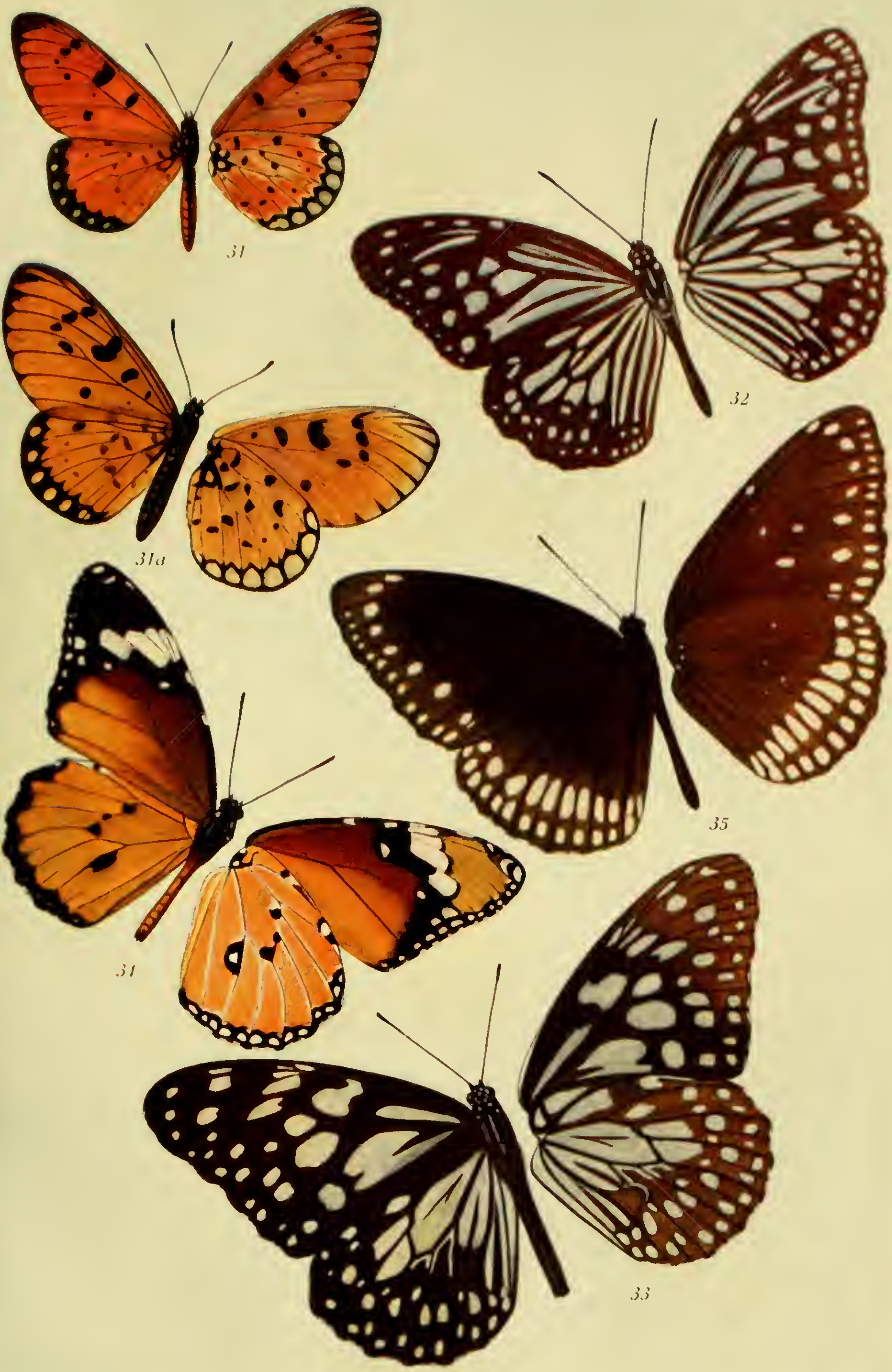


Fig. 5.—*Libythea myrrha*, ♂. 1/1.

B. Discocellular cell open or, if closed, lower discocellular very slender, inconspicuous.

a. Palpi small, narrow, sharp in front...... .... *Morphinæ.*

b. Palpi large, broad, rounded in front .... *Nymphalinæ.*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31a
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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. Hentschel-Colourtype.

Of these six sub-families, three contain only one genus each and two of these genera are represented only by a single species that will come into these papers. The three sub-families are *Acræinæ*, *Libytheinæ* and *Morphinæ*, the first represented by *Telchinia violæ* (Pl. E., figs. 31 & 31*a*), the second by *Libythea myrrha* shown in woodcut fig. 5. There are three species of *Morphinæ* mentioned, all very similar to each other and the males of the three are distinguished from all other butterflies by having a large circular patch of oily looking scales in the centre of upperside of hindwings. As regards the remaining three sub-families, the *Nymphalinæ* can be recognised by the character of the total want or the obsolescence of the discoidal nervules, leaving thus only two groups between which to distinguish. The Satyrines are, with one single exception, all earthy-brown in colour with or without some white markings, and have generally eye-marks on them. The exception is *Elymnias caudata*, the female of which is tawny and very like *Danais plexippus* on the wing, with the apical white band and black veins, the male is black-purplish as to forewings and tawny on the hindwings: both have small tails to the hindwing which distinguishes them at once from any danaine insect. The Danaines are all either black-brown with white markings along the margins (*Euplœa*), black with many bluish grey-streaks (*Danais aglea* and *D. limniace*) or tawny with black markings and a white apical band (*Danais plexippus* and *D. chrysippus* and their varieties.) These last also have all a disagreeable smell, are very difficult to kill by ordinary pressure and their wings are covered with a scaling which is not nearly so easily damaged, specially in the streaked light-coloured species, as in other kinds of butterflies. Three species of *Danais* and one of *Euplœa* are figured on Plate E., figs. 32 to 35. The Danaines and Nymphalines are nearly all sun-loving insects, the former are slow and weak of flight, the latter strong on the wing and rapid in their movements; none of them are confined to the plains and by far the larger number are purely hill and forest species. *Telchina violæ* is as often seen in the dryest and hottest part of India, *i.e.*, Sind, as it is in the regions of heaviest rainfall preferring, in both places, hilly ground to absolute flat plain: it and one other Himalayan species (*Pareba vesta*, F.) are the only two Indian representatives of the large African family of the *Acræinæ*; the insects are all protected by a disagreeable smell caused by a yellow juice exuded as a defence against attack; they are, as might be consequently inferred, rather difficult to kill by pressure, sham death when caught, are slow, weak fliers; *T. violæ* rarely rises much above the ground and and generally keeps a straight course. *Libythea myrrha* is a forest butterfly but is fond of the sun: it flies little and never for any distance but is fond of basking on leaves of trees and dead twigs with the wings closed over the back and the front wings sunk far within the hinder pair; when in this position on a dead twig the insect looks very like a piece of dead leaf, the colour and shape of the wing abetting in the deception. The Satyrines and Morphines are all insects of the shade, shunning the sun and frequenting the undergrowth in forests. Grass and thickets in open country harbour several species of the former, though the section mostly affects the jungles; the latter are never found in the open away from bamboos and trees. The majority of the former are weak fliers, never rising far from the ground and fly only for a short distance at a time, to settle again shortly amongst dead leaves or in a dark place on the surface of the earth. The genus *Lethe* is an exception to this, for they fly fast, often rising high among the trees when disturbed and resting on tree-trunks and branches high up. *Discophora*, representing the *Morphinæ*, frequents the high jungles as a rule, is an extremely powerful flier, rivalling herein the strongest of the Nymphalines (*Charaxes*, *Doleschallia*, &c.) in pace and the length of time it will remain on the wing. The caterpillars of the different subfamilies are very dissimilar, though each one has its own characteristic type with the exception of the *Nymphalinæ* where some of the groups differ in the larval form from one another quite as much as any of the subfamilies. These larvæ may be classed as follows:—

Danaines.—Cylindrical larvæ with smooth surface, provided with two to four pairs of thin, fleshy subdorsal tentacles; generally banded transversely. Head smooth, shiny, round, marked with spots or bands (*vide* Pl. I, fig. 8).

Satyrines.—Fusiform larvæ with, generally, a rough surface; often with longitudinal stripes; always ending in two tail points which are sometimes closely applied to each other to form apparently one (*Lethe*). Head square or round, generally divided into two lobes by a depressed central line; when square always with a point or horn on vertex of each lobe, sometimes also when round (*Ziportis*) when the two points may be so close together as to seem one (*Lethe*) (*vide* Pl. I, figs. 1 and 2).

MORPHINES.—Cylindrical larvæ, covered with long hairs (unique in this among Butterflies) though never thickly enough to obscure surface when full grown : surface soft and smooth otherwise ; two tail points. Head broadly heart-shaped, narrow side uppermost, in *Discophora*, slightly two lobed. In some species the head is ornamented with horns, but none of these come into these papers (*vide* Pl. I, fig. 3).

LIBYTHEINES.—Cylindrical with, however, the head and last segment rather narrow ; surface roughened with tranvserse rows of very short bristles not very visible to the eye. Head round with a somewhat shallow and broad central depressed line (*Libythea myrrha*).

ACRÆINES.—Cylindrical in shape, the body armed with spines as in the typical Nymphalines. Head smooth, round, rather small. The chrysalis is also similar to that of the nymphaline *Ergolis*.

NYMPHALINES.—Cylindrical typically, the body armed with spines in the arrangement of which, as well as in the relative size, there is considerable variety. The head rather large with a pair of horns or not. The *Neptis* group have smooth larvæ with pear-shaped heads, one section without processes to any of the segments, (*N.viraja*), another with fleshy dorso-lateral growths on segments 3, 4 and 12, representing the spines of the typical section, there being often considerably developed tubercles on other segments as well. The *Apatura* group has naked larvæ with tail points and horns on the head. The *Charaxes* group have fusiform larvæ like *Apatura*, but the tail points are very short, the anal end is more broadly square and the head is very large and ornamented with four horns which remind one strongly of bison-horns in *Ch. imna* and *Ch. schreiberi*, though they differ with the species a good deal. The caterpillar of *Cyrestis* is extremely abnormal in shape : fusiform with rugose surface and a long fleshy, erect process dorsally on segments 6 and 12, the former curved back, the latter forward, both with serrated hinder edge ; the head is smooth with two horns, stout at the base and separated by a narrow sinus, slightly diverging at first, then strongly curved outwards becoming pointed at the tips, recalling the shape of the horns in some of the wild sheep. The genera *Dophla*, *Euthalia* have a peculiar larva with a pear-shaped, large, smooth head and cylindrical body ornamented with a row of long conical fleshy processes, each more than twice as long as the body is broad and furnished throughout their length with strong setæ, proceeding from the margins of segments 3 to 12 symmetrically outwards all round, the first and last pairs covering the first two and last two segments of the caterpillar, respectively. The pupæ of these last two groups are also very characteristically shaped (*vide* Pl. I, figs. 4 to 11).

SUB-FAMILY—*DANAINÆ.*

A. Colour of upperside chiefly dark-brown or black spotted with white.................................. EUPLŒA.
B. Colour tawny or black streaked with bluish-grey.. DANAIS.

Genus—DANAIS.

A. Wings tawny.
  a. Veins prominently black.
    a^1. Hindwing all tawny. Exp. 2″·8-2″·9 .... *plexippus.*
    b^1. Hindwing black streaked white. Exp. 2″·75-3″·05 .... *hegesippus.*
  b. Veins concolourous with wing.
    a^1. Forewing with apical white band
      a^2. Hindwing all tawny. Exp. 2″·75-3″·3...... *chrysippus.*
      b^2. Hindwing streaked white (var. of *chrysippus*).. *alcippus.*
    b^1. Forewing without apical white band (also a var. of *chrysippus*) .... *dorippus.*
B. Wings streaked black and bluish-grey.
  a. Cell of forewing black with short white streak at base. Exp. 3″·8-2″·2 .... *limniace.*
  b. Cell of forewing white with black central line towards apex. Exp. 2″·75-3″·95 .... *aglea.*

Genus—EUPLŒA.

A. Forewing underside : cell immaculate.................. *kollari.*
B. Forewing underside : a white spot towards end of cell
  a. Forewing underside : a complete series of six white spots between veins immediately outside cell .... *coreta.*
  b. Forewing underside : spots above veins 5 and 6 of this series always wanting............................ *core.*

or

A. Forewing, upperside, male : two parallel, broad, silky looking streaks above centre of inner margin. Exp. : 3″·65-3″·8 .... *coreta.*

B. Forewing upperside, male, a single short line in the same position. Exp. 3″-4″ .... *core.*

C. Forewing upperside, male : a more or less circular rather large silky looking spot in the same position. Exp. 4″ .... *kollari.*

The silky streaks in the first are about 10mm. in length by 1mm. in breadth, in *core* the line is only 3mm. in length and very narrow, in *kollari* the spot is about 3mm. in diameter. *E. core* is figured on Plate E, fig. 35, but the brand or sexmark between veins 1 and 2 is not perceptible : this is a mistake of course in the picture.

Other butterflies of this sub-family are figured on Plate E. : *D. aglea.* (fig. 32), *D. limniace* (fig. 33), *D. chrysippus* (fig. 34).

There are forty-six well-defined species of the *Danainæ* found in British India according to Colonel Bingham. And there may be more as he treats many forms as races which up to the present time have been looked upon as good species. Only seven of his species come into these papers and, of these, five are widely distributed, while two (*E. coreta* and *E. kollari*) are confined to the sea-coast south of Bombay, though *kollari* is also said to occur in Bengal and Orissa. *Danais chrysippus* is very common everywhere, extending even to Europe westwards ; *Euplœa core* exists throughout India as do also *D. plexippus* and *D. limniace* ; *D. aglea* is found in Mysore and the Southern Mahratta Country. Many of the Burmese *Euplœa* are shot with blue.

The danaine insects are all protected by smell in the imago state as has already been pointed out, as well as by the construction of their bodies to resist pressure. The males of nearly all species are distinguished by the possession of " male-marks " on the fore or hindwings. *Hestia* has no such marks. *Danais* has them only on the hindwing where they take the form of a pocket below vein 2 near its origin or patches of scales near the ends of veins 1*a*, 1 and 2. *Euplœa* has them on both wings or only on one pair according to the species ; they consist of silky streaks or brands on the forewing over the inner margin ; a single short streak, two longer parallel streaks or a single spot or blob, on the hindwing they take the form of a patch different from the rest of the wing in colour about the subcostal vein. In this last genus also the males have paired tufts of hair, yellow or greenish in colour which they can protrude from the last segment of the abdomen. These tufts have a pronounced scent.

There is a very large member of the sub-family, found in the damp jungles of the Western Ghats, south of Bombay, called *Hestia malabarica*, with a span of 4″·5-6″, known as the "wood-nymph" which may be mentioned in passing as constituting an example of the only other genus of the three forming the sub-family of the Danaines in India. It is also quite possible the insect might be met with in the neighbourhood of Mahableshwar.

These butterflies have all a slow somewhat fluttering flight but remain long on the wing at a time and travel considerable distances, rarely loitering in one place: though, on hot steamy days in the rainy months, the males of *Euplœa* may be seen beating backwards and forwards in open spaces in wooded places, sailing along at intervals with the wings held very much inclined to each other over the back, never horizontal, their bodies bent down and the curious feathery looking yellow or greenish scent-brushes—they smell very strong at such times and are quite perceptible in the still air even to the human sense—protruded from the end: probably endeavouring to attract the females. At times, also, great numbers of several species mixed, often all five of the common ones, may be found sitting together with the wings closed over the back, as is customary for their kind, on a species of *Crotolaria* with yellow flowers in the jungles; and it is not uncommon in the hot weather to put up a crowd of hundreds from a small patch of the plant. It is difficult to say what the attraction is. It is not the flowers for there are, as often as not, no flowers on the plants affected; frequently even withered stems are chosen. *Crotolaria* is a genus containing Indian Hemp from which intoxicating principles are extracted. Perhaps this may explain the insects' liking for the plant: the heat probably causes an exhalation of intoxicating fumes. The black and white *Danais aglea*, *D. limniace* and *Euplœa core* with a *D. plexippus* at odd intervals may sometimes be seen flying, in a continuous stream which may last for hours, in one direction; thousands must pass in the time. Why they should do this is not known, though scarcity of larval food has been suggested as a possible cause for their leaving certain localities. In the districts covered with heavy jungle, however, these migrations are as common as it elsewhere and there is certainly never any lack of food in such places.

The Milkweed or Monarch Butterfly said to be found occasionally in England, *Anosia erippus*, Cram., is belonging to this sub-family:

is called *A. plexippus* in South's Butterflies of the British Isles, but is certainly different from our Indian *Danais plexippus*, L. in appearance ; the larvæ are also quite distinct. There are thus, with *D. chrysippus*, L. above mentioned, only two members of the whole sub-family which occur in Europe.

The danaine egg is dome-shaped, a good deal higher than broad and has a shiny surface dented all over with little rounded depressions, formed by many rather broad ribs from base towards top, joined by numerous smaller ridges at right angles ; the ribs do not quite meet on the top of the dome but subside gradually into the general level around a finely reticulated surface in the centre of which is the micropyle or opening through which the fertilisation takes place. The egg is generally laid on the underside of a leaf, always singly but occasionally also on the upperside ; sometimes on a twig or dead stem of a creeper-foodplant, flower-bud, &c.*

The larva has been alluded to before as cylindrical in shape with a smooth surface, naked except for the tentacles on two to four of the segments 3, 4, 6 and 12, those on segments 3 and 12 always being present, and a round, shiny and smooth head marked with bands or spots. The marking of the body is either in transverse bands or a mixture of spots and such bands. The little caterpillar eats the shell of the egg as its first meal and sits on the underside of a leaf, eating holes in it, as a rule, instead of beginning from the edge as most larvæ do (*vide* Pl. I, fig. 8).

The chrysalis is characteristic in shape, quite rigid in the abdominal segments, short and dumpy as a rule, longest in *Hestia*, longer in *Danais* than in *Euplœa*, with a slightly humped thorax and is fattest about the middle of the abdomen where there is a distinct ridge in *Danais* in the centre of segment 7 from spiracle to spiracle across the body. Segment 6 is exceptionally long. The colour is generally green in *Danais* when formed in nature among green leaves, very shiny, ornamented with brown, silver or gold spots and in *Euplœa* often suffused with gold or silver. Of course, the pupa always hangs free by the tail as is the case in all *Nymphalidæ* (*vide* Pl. I, fig. 8*a*).

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* The *Hestia* egg has the intersections of the ribs with the cross-ridges somewhat raised and knob-like.

The species of butterflies may be classified according to their larval form as follows :—

A. Larva with four pairs of tentacles.
a. Larva banded black and white with red spots ... *Hestia malabarica.*
b. Larva banded brown and white ; no spots.
a^1. Spiracular band white touched with orange, tentacles flesh-coloured or pink, front pair generally held curled up .... *Euplœa kollari.*
b . Spiracular band yellow suffused orange, tentacles brown, front pair never curled ... *Euplœa core.*
B. Larva with three pairs of tentacles.
a, These tentacles on segments 3, 4, 12 .... *Euplœa coreta.*
b. These tentacles on segments 3, 6, 12.
a^1. Body banded black and white with yellow subdorsal spots .... *Danais chrysippus*
b^1. Body banded black and white with white spots as well as yellow ones..................... *Danais plexippus.*
C. Larva with two pairs of tentacles.
a, Larva banded broadly black and white............ *Danais limniace.*
b. Larva claret-brown spotted with yellow and white *Danais aglea.*

The foodplants of the caterpillars of the subfamily are confined to the botanical families the *Urticaceæ* (Figs and Nettles), *Apocynaceæ* (Dogbanes), and *Asclepiadeæ* with no English representative though *Asclepias cornuti,* called Swallow-wort, is introduced in gardens of late years. All these plants have a more or less milky juice and the plants composing the last family are known as Milkweeds. In India the Milkweeds are nearly all creepers, though the best known member of it, *Calotropis gigantea,* common everywhere in the Plains and known by the vernacular name of "akk" or "rui", "madar", is an erect shrub ; never growing to any great height but always conspicuous by reason of its gregarious habit, its thick leaves and branches covered with a white powder, exuding a copious white milk when torn or wounded, and its purplish flowers. The Dogbanes and Milkweeds are very plentiful in India and few hedges in the country are without a creeping species of one or the other. *Hestia* caterpillar has only one foodplant, the apocynaceous species *Aganosma corymbosa* which is only found in damp hilly jungles : for which reason the butterfly is limited to such localities ; the larvæ of the several species of *Danais* have several foodplants each ; that of *Euplœa coreta* seems to have only one, that of *E. kollari* has certainly more than one belonging to the Fig family; *E. core* will eat many things belonging to all three families.

DESCRIPTION OF SPECIES OF DANAINÆ.

1. **Danais plexippus**, *L.*—Male and female alike. The *upperside* of both wings is tawny, the veins bordered black; the apical half of forewing, costal and inner margins also black; three white spots beyond the cell, a white band across the apex divided by black veins, then a double row of white spots. Hindwing with no white except the double row of spots on a black marginal border. *Underside* similar but paler. Antennæ black; head and thorax black, spotted white; abdomen dusky tawny marked with white beneath. The male has a pouch on the underside of hindwing near vein 2 probably connected with the emission of scent. Exp. 72—100mm.

This was once known as *D. genutia*, Cramer. Some specimens from dry regions show a tendency to replace the tawny part of hindwing by white thus approaching the next species.

Larva.—The shape is cylindrical with the last segment perpendicular to longitudinal axis of body, the second segment slightly narrower than head, and with three pairs of tentacles, one to each of the segments 3, 6 and 12, all subdorsal, the first pair about 6·25mm. long and moveable, the others shorter and fixed. The head is squarely round, quite smooth and shiny and is black in colour with white marginal band, another inside this and parallel to it, a white clypeus and labrum. The colour of the body is velvety black marked with bluish-white and yellow spots and lines of the former colour as follows:—the belly is unmarked, divided from the dorsal half by a broad yellow band partly including the black spiracles; the part of the body above this has, on each segment, two central subdorsal yellow spots, one on each side of dorsal line three bluish-white spots in front of them along front margin of segment, one dorsal, one on each side subdorsal, and three parallel short bluish-white lines behind each yellow spot, all parallel to hinder margin of segment, the first one shortest, the hindermost longest; exceptions to this arrangement being segment 2, where there are only two white spots, and segment 12 where there are only two lines instead of three and these are continuous over the back. The tentacles are placed under the yellow spots, are black in their top halves with red bases. L. 37mm.; B. 7mm.; H. 6mm.; L. of tentacles of 3rd segment: 6·25mm.

Pupa.—Hemispherical in the posterior half where, slightly on the ventral side of the pole, is placed the stout, somewhat flattened, shiny black cremaster with ventral and dorsal extensor ridges and tuft of suspensory hooklets at extremity; in the ventral part the hemisphere is somewhat depressed, passing evenly into the surface of the wings. The base of the hemisphere at centre of segment 7 is dorsally ridged from wing to wing with a line of small black beads or knobs on a silver band and from this ridge forward the pupa decreases in diameter, being all but circular in transverse section in this part, up to the shoulders; the dorsal portion of the thorax or segment 3 is humped suddenly from the hinder margin and gradually falls in the dorsal line in a curve of a quarter circle to the front of pupa; this front or head is transversely square, rounded at right angles to its breadth and has a small conical tubercle at each end in front of each eye; laterally the pupal breadth is rapidly narrowed from shoulders to these tubercles. The surface is smooth and shining. The colour is green among green leaves but may be pinkish bone-colour when pupation takes place in a box, &c.; when green the ridge on segment 7 is silver with black beading, there is a gold tubercular spot on each shoulder, a golden spot on each side immediately behind apex of thorax, one on hinder margin of eye dorsally, one at base of each antenna, and one in centre of each wing; four black spots ventrally before cremaster, which is also black. L. 15·5mm.; B. at segment 7 where it is broadest 7·5mm.; H. at same place 8·5mm.

Habits.—The egg is laid singly on the underside of a leaf and the larva always lives there; when it first emerges it makes its earliest meal of the eggshell, after which it eats tender leaves, old leaves, stalks, any part of the plant that is eatable, voraciously, growing accordingly. Wanders to pupate fixing itself firmly to the underside of a leaf, twig, &c., for the purpose. The imago is not a butterfly of the open plains, preferring the vicinity of forest, woods and places overgrown with bush and scrub. Compared to *D. chrysippus* it is an insect of regions of good rainfall. It has the weak danaine flight and associates with other *Danais* and *Euplœa* in migrations and at *Crotolaria* as mentioned above. It is not often seen at flowers. It is found throughout India, in China and Malay. The foodplants of the larva are Asclepiads of the genus *Ceropegia*, mostly creepers of small size growing in the underwood.

2. **Danais hegesippus**, *Cramer.*—Male and female like *D plexippus,* but for the greater extent of black on the apical half and margins of forewing; the preapical white band is divided into spots. The hindwing is all black with the cell and intervals between veins beyond it streaked with white. On the underside the ends of the white streaks of hindwing are washed with yellowish and there are additional white streaks in interspaces 6 and 7. *Exp.* 70-78 mm.

The insect is found in Bengal, extends to Tenasserim and the Nicobars. Malacca and Sumatra; there are intermediate forms between it and the last in the Malayan region though not in India; nothing is known of the transformation, though the larva and pupa are sure to be very similar to those of *D. plexippus.*

3. **Danais chrysippus**, *L.* (Pl. E, Fig. 34)—Male and female: forewing tawny, darker towards costa; apical third and costa narrowly black with one or two white spots on latter, another sometimes at end of cell, an oblique preapical

white bar ending in four spots at outer end and a more or less complete series of white terminal spots. Hindwing: colour paler, three black marks on discocellulars; an incomplete series of white spots on a terminal narrow black band. *Underside* has the ground-colour of the hindwing and a triangular area at apex of the forewing ochraceous. Antennæ black; head and thorax black spotted with white; abdomen ochraceous above, whitish below. Male sex-mark as in *D. plexippus*. *Exp.* 70-84 mm.

Larva.—Cylindrical; shape the same as that of *D. plexippus*. Here also the tentacles are on segments 3, 6 and 12, the pair on the first one moveable, and longest, the others fixed; last segment ending in a rounded edge with a shiny black boss on it dorsally. The head is roundish, nearly as broad as segment 2. the face rather flat with a slightly depressed central line, clothed with not very short, erect, black hairs rather sparsely; black in colour with a marginal thin white band, another one inside and parallel to it, both ending at jaws, a white triangular clypeus and a white labrum. Spiracles longly oval, black, on the yellow spiracular band. The surface of body clothed as well as the tentacles with sparse, short, erect, black hairs. Colour is dark chocolate-brown or black with a yellow spiracular band and a dorso-lateral row of large yellow spots; a small carmine spot at base of tentacles 6 and 12, tentacles 3 and 12 growing out of the yellow spots; segment 2 banded black and white; the yellow spots are wanting on segments 2 and 13, 14, between each pair of yellow spots are 3 or 4 white bands over dorsum, starting from the spiracular band on each side: this band is composed of continguous spots shaped like molar teeth, the fangs pointing upwards, or like drops. Legs, prolegs black with a white band on the bases of the latter. L. 38mm; B. 7mm.; H. 6mm.

Pupa.—Is the same shape as that of *D. plexippus*; the ridge on segment 7 is here composed of a double row of beads, close together; the cremaster is a short, narrow oblong with the hooklets at extremity and ventral extensor ridges. Spiracles longly oval, the colour of the pupa, rather large; those of segment 2 mere slits. Surface of pupa smooth and shiny. Colour green; cremaster and extensor ridges black; ridge of segment 7 gold in front, black behind; head-points gold, shoulder tipped with gold and a subdorsal gold spot on hinder margin of thorax. L 18·5mm.; L. from front to ridge 15mm.; B. at segment 7: 8mm.

Habits.—The egg is laid singly on the underside of the leaf where the larva lives; eats the egg as its first meal, then the substance of the leaf leaving the top cuticle; afterwards from the edge in the ordinary way. Wanders to pupate, proceeding as does *D. plexippus*: quite normally. The imago is perhaps the strongest of the Danaines on the wing. It is found everywhere in India from the driest desert regions to those of heaviest rainfall, but is scarcest in the forest-clad hills. It extends westward to North Africa and Greece in South Europe, eastwards to China and Celebes. In fact, it has the same area of distribution as its foodplant *Calotropis* under its two forms *C. gigantea* and *C. procera*. *Asclepias curassavica* of the same family, introduced from America and spread all over India, is also a favorite foodplant. The larvæ are much attacked by ichneumons. The species is a dry-weather one in the regions of heavy rainfall.

Two varieties of this insect with the hindwings more or less white have been named *alcippus* and *alcippoides* by Cramer and Moore in the past : they are found in the dry regions chiefly ; another variety in which the apical white band is altogether or nearly altogether wanting on the forewing, was christened *dorippus* by Klug and *klugii* by Butler. This latter variety is found everywhere in India where the parent form exists.

4. **Danais limniace,** *Cramer* (Pl. E, fig. 33).—Male and female ; *upperside* black with bluish-white semihyaline spots and streaks. Forewing below cell : two streaks, sometimes coalescent, with a spot beyond ; in cell : a streak from base and an outwardly indented sport at apex ; a series of five streaks and two spots from costa towards inner margin outside cell, a single spot beyond in interspace 3 and a double irregular submarginal series of spots, the inner the larger. Hindwing : interspaces 1*b*, 1*a* and 1 with streaks from base, double in 1*a* and 1 ; cell with a forked broad streak or wholly white with a central dark forked line ; beyond cell in interspaces 2 and 3 a slender fork, in 4 and 5 a broad elongate spot and in 6 a quadrate spot ; on the wing beyond these two series of irregular somewhat scattered spots, submarginal and marginal. *Underside* black, apex of forewing broadly and outer two-thirds of hindwing olive-brown ; streaks and spots as above. Antennæ, head and thorax black, the latter two spotted and streaked with white ; abdomen dusky above, ochraceous spotted with white beneath. The male has a pouch on the underside of hindwing below vein 2. Exp. 98-106mm.

Danais septentrionis, Butler, differing from this species in the ground-colour being darker and the markings narrower, more distinct and of a bluer tint, is said to be a separate species. Colonel Bingham says that the short streaks immediately outside the cell above vein 5 of forewing are always outwardly acute, never truncate as in *limniace*. The form, however, seems only to be found in the hills : Simla to Sikhim ; Orissa, Southern India, Kanara, Malabar and the Nilgiris ; Ceylon ; Assam ; throughout Burma and Tenasserim, to Malayan Subregion. All regions of considerable rainfall.

Larva.—The shape is the same as that of *chrysippus* ; body smooth, having a pair of tentacles on the 3rd and 12th segments only, the former pair longer and moveable, the latter half the length, fixed. The head is similar also in colour and markings to the last species. The spiracles are black with a fine raised shiny border, oval in shape, rather large, situated on the dorso-ventral band. Colour of body is brown-black above, banded with blue-white : whiteygreen on belly with bands and blotches of white on segments 4, 5, 11 and 12; the tentacles are black with a white stripe inside and outside for half their length; on segment 2 are two white bands, the first near front margin reaching spiracles on each side and curving slightly back at ends, the second, along hinder margin, not quite reaching dorso-ventral line on each sides; segment 3 has four similar bands, parallel besides a fifth continued from stripe on tentacle to the dorso-ventral line; segment 4 has four narrowish bands and a central interrupted one of which the basal portions only on each side exist; segments 5 to 11 have four narrow bands, an anterior broader one and an interrupted one immediately behind the broader one like that on segment 4; segment 12 has a broad anterior band, the stripes of tentacles continued down sides and two bands behind; anal segments have a pair of bands anteriorly coalescing on margin and a posterior pair surrounding the shiny black dorsal boss of the anal flap; connective membrane between the segments yellowish-orange; prolegs and legs shiny black with basal and preapical white band. L. 37mm.: B. 7mm.; L. of front tentacles, 9·5mm. (*vide* Pl. I., fig. 8).

Pupa.—Shape the same exactly as that of the last species. Spiracles oval, colour of pupa. Surface smooth and shiny. Colour naturally green (if among dead, dry leaves or in a wooden box it is pinkish bone-colour), line of knobs on ridge of segment 7 golden, a golden spot on point of shoulder, a central dorsal one on segments 5 and 6, one behind spiracle of latter segment, one on margin of wing at segment 4-5, one at base of antenna, another on eye, another between eye and thorax, one lateral at hinder margin of thorax and one subdorsal just above it, one or two on wings of which the one near outer centre is constant; a few black marks running out obliquely from cremaster ventrally. L. 22·5mm., B. 10·7mm. = H., both at segment 7; H. at thorax-apex, 5mm.; B. at shoulders, 7mm.; B. at front of head, 4mm. (*vide* Pl. I. fig. 8*a*).

Habits.—The habits of laying the egg singly on the underside of a leaf and of the larva are the same as for the preceding species. The imago keeps much to wooded country and hedges around villages where its chief foodplant, *Dregea volubilis*, Benth., a climbing Asclepiad, with large heart-shaped or oval leaves, green drooping umbels of flowers and watery juice, is found and around which the butterfly may commonly be seen flying. The plant is very common but loses its leaves during the dry weather. The insect exists throughout India and Burma and beyond as far as Siam and China. The larva has been found on other plants of the order *Asclepiadeæ* also besides the one mentioned: *Calotropis*, *Hoya*, for example. It is chiefly a monsoon species.

5. **Danais aglea,** *Cramer.* (Pl. E fig. 32).—Male and female: *upperside* black-brown with subhyaline bluish-white streaks and spots: the forewing has a short streak from base along inner margin, two longer and thicker ones.

united at base and generally also exteriorly below cell, a broad streak divided by longitudinal lines into three in it; a basal spot in interspaces 2 and 3; an irregular discal series of three spots with two streaks above; two series of submarginal spots, the inner large, one in each interspace, curved in along the costa, the outer small, two spots to each interspace. Hindwing: interspaces 1*a*, 1*b*, with broad streaks from base; 1 and cell with two streaks joined at base in each, the latter with short streak obliquely between their apices; 2-8 with broad, elongate, inwardly pointed spots; irregular double submarginal series of spots. The *underside* is similar, the markings rather larger. Antennæ black: head and thorax black spotted white; abdomen black-brown, ochraceous beneath. The male has patches of scent scales on hindwing near apices of veins 1*a*, 1 and 2 with a thickening of veins 1*a*, 1, through the patches. Exp. 70-100mm.

The Northern and Eastern form, *melanoides* has the blue-white markings in interspace 1 of forewing and cells of both wings much broader, and ground-colour in them may be reduced to a slender line. Typical *aglea* is South Indian as far north as Poona. However, *aglea* has been taken in Burma and the other in Mysore.

Larva.—The shape of the larva is normal: cylindrical; there are two pairs of subdorsal tentacles, one on segment 3, the other on 12, the first pair moveable and long, the latter fixed and half the length; there is a shiny patch dorsally on anal flap. The head is round, shiny black in colour with white clypeus and labrum and eight white spots: one on apex of each lobe, another on face just below, one at bottom hinder margin above base of mandible, one at each basal angle of clypeus. The colour of the tentacles is claret-red marked on the inside and outside for half their length with a white stripe. Colour of body is blackish brown-claret, concolourous on belly, spotted yellow and blue-white on dorsal half; segments 3 and 4 have each a pair of large sub-dorsal spots on each side, a dorsal yellow spot all near front margin besides five white spots below laterally and three parallel rows of blue-white ones over dorsum on posterior part; segments 5 to 12 are similarly marked except that they have one subdorsal yellow spot instead of two and an extra one, spiracular, below; segment 13 has a front row of four large yellow spots and a hinder row of four similarly arranged, *i.e.*, one subdorsal and one spiracular on each side. Legs and prolegs shiny black with two white spots on base. L. 33mm.; B.5·5 mm.

Pupa.—The shape is like that of *D. plexippus* except that the pupa is somewhat slighter and there is no beading to the ridge on segment 7. The surface is smooth and shiny. Colour is yellowish-green with a row of 10 black spots along centre of segment 7 instead of the usual ridge, a parallel row of 8 black spots on segment 8, segment 9 with 4, anal segment with 4 black long marks, one subdorsal and one lateral on each side; on segment 6 there is a golden dorsal, lateral and spiracular blotch: 5 in all; on segment 5 a lateral golden mark; on segment 3 is a golden spot at apex of thorax, a subdorsal one just behind apex and two lateral ones at equal height on each side ; segment 2 has a lateral and a dorsal gold spot, there is one on each eye and one on each side of each eye ; wings also marked with gold. L. 18mm. ; B. 9mm. ; H. 9·5mm.

Habits.—The habits as regards the laying of the egg, the life of the larva and the pupation are the same as for the preceding species. The species is common everywhere throughout its range, has a weak flight though it remains long on the wing flying about somewhat aimlessly, migrates with the others, frequents *Crotalaria* and is not a frequent visitor of flowers. The foodplant of the larva is *Tylophora carnosa*, D. ; also *T. tenuis*, Blume, and *Cryptolepis Buchanani*, Roem. and Sch., all Asclepiads. The distribution is India and Burma.

6. **Euplœa coreta**, *Godart.*—Male and female : *upperside* dark-brown, somewhat broadly paler along outer margins with a row of largish white spots in interspaces 1—7 followed by a row of smaller ones, two to each interspace, inside outer margin on forewing ; hindwing similar, the spots larger, the inner row elongate and paired in interspaces 1*b*, 1—3. *Underside* browner, spots as above and a spot towards end of cell of forewing with complete series of six spots between nervures immediately outside cell. The male has a pair of broad parallel silky bands on upperside of forewing in interspace 1 ; in the female their position is vaguely traceable. Exp. 92-96 mm.

Larva.—The shape is the same as for *Danais* : there are paired tentacles on segments 3, 4 and 12 which are longest on segment 3, shortest on 12, dull-indigo in colour and straight. These tentacles are much longer than in *E. core*, the next species. The head is round, smooth, shiny, black with a marginal white band and another down each side of the triangular clypeus not continued above its apex and a white labrum. Surface of body smooth and greasy looking. Spiracles oval, black, shiny, of ordinary size. The colour of the body varies somewhat in shade but is ordinarily a light violet-green above, chocolate-green on the belly ; segments 3 and 4 are always slightly yellowish dorsally ; a yellow spiracular line divides the belly from the dorsum with a slight yellow shade around the spiracles ; the extreme base of all three pairs of tentacles is yellow ; segment 2 is light yellow with a shiny black subdorsal spot ; the anal flap is the same colour with a large dorsal shiny black patch covering three-fourths of the segment ; all the legs shiny black. L. 59 mm. ; B. 6 mm. ; L. of tentacles of segment 3 : 14 mm. ; of segment 4 : 9 mm. ; of segment 12 : 6 mm.

Pupa.—The pupa of *Euplœa* differs from that of *Danais*, in that the dorsal line from thorax to segment 7 as well as the lateral are both concavely curved and there is no sign of a ridge along centre of segment 7 ; it is dumpier, smoother and more compact altogether. That of *E. core* is compact, the abdomen short and sub-hemispherical from segment 7 to end, the ventrum slightly flattened ; the cremaster forms a stalk a little on the ventral side of pole of hemisphere and is somewhat bent down ; head square in front, rather high rounded on the edges with somewhat prominent eyes ; thorax (segment 3) is humped and is as broad at the shoulders as the abdomen at segment 7 ; the margin between segments 2 and 3 is very indistinct ; segment 2 is a regular, semi-circular shield-like piece ; thorax front margin is rounded and the dorsal line runs thence up and out over the hinder margin in a rounded apex ; dorsal line of segment 4 is parallel to the longitudinal axis of the pupa, that of segments 5 and 6 runs up to 7 in a gentle curve ; there is a shallow, broad constriction of wings and dorsal region about segment 4. Spiracles oval, light brown, of the usual size. Colour of pupa is silver with a broad subdorsal and spiracular band meeting on segment 6 which is entirely lightish brown as are the bands and segments 4 and 5, except dorsally ; shoulders and inner margin of wing, vertex of head, a narrow brown band along outer wing-margin, a broad thoracic dorsal band forking from apex to hinder margin, an oblong mark on wing beyond discoidal cell : all lightish brown ; the cremaster is shiny black, has a small knob at extremity and a round lateral tubercle at base ; anal clasper-scars black. Whole surface shiny and smooth. L. 18·5 mm. : B. at segment 7 : 8·5 mm.

Habits.—The egg is laid on the underside of a leaf ; the larva first eats the eggshell, then takes to the leaf ; living always on the underside. The pupation takes place in the same way as for *Danais*. The caterpillar is much attacked by hymenopterous parasites. The butterfly is not common even in its limited habitat in the hills of Southern India along the west coast and is hardly seen at all in the dry months. It is fond of damp places and does not join in migrations. The foodplant of the larva is the apocynaceous creeper *Ichnocarpus frutescens*, Br.

7. **Euplœa core.** *Cramer.* (Pl. E, fig. 35).—The description is the same as for *E. coreta*, the last species, except that on the underside of forewing the discal spots above veins 5 and 6 are never present here and, in the male, the two broad brands are replaced by a short, narrow line. *Exp.* 78-98 mm.

Larva.—The larva is of the usual shape with a shiny black patch dorsally near extremity, a dorsal black shield posteriorly on segment 2 and four pairs of subdorsal tentacles on segments 3, 4, 6 and 12, one pair to each, the pair on segment 3 longest, reaching beyond the head, moveable, the last pair shortest : about as long as the larva is high, fixed. Head similar to that of the last species with a covering of very fine, adpressed, colourless hairs ; black with marginal white band, another down each side of clypeus and a white labrum. The spiracles are oval, shiny black and situated in the orange band. Surface of body smooth, the tentacles densely covered with short, erect, black hairs. Colour of tentacles and body dark-brown, sometimes with a tinge of claret, transversely banded with white (or colour of body bluish-white, banded with brown), five bands to each segment, of different lengths on one segment running into an irregularly bordered broad white spiracular band which is more or less strongly suffused with orange. The ground-colour of the larva is sometimes nearly violet. L. 47 mm.; B. 6·5 mm.; H. 6 mm.; L. of tentacles of segment 3: 10 mm.

Pupa.—The pupa has nothing to distinguish it from the last in shape. The colour is silvery-golden all over with the wing-line along the thorax, a dorsal thoracic band running back and forking near apex, a subdorsal and lateral abdominal band, all of a dirty light brownish colour; cremaster black as well as last segment; two rows of black spots on abdomen, one supra-spiracular, one lateral to each segment. The spiracles are oval, slightly raised and the colour of the body. L. 19 mm.; B. 9 mm. Larva turns rose-coloured before pupating.

Egg.—Nearly cylindrical for 2/3 its height, the top 1/4 rather pointed, dome-shaped. Surface covered with many longitudinal ribs of small height, rounded in section and broad, the interspaces being crossed by numerous minor ridges at right angles; the two sets covering the surface with many square, round-bottomed cells. Colour white immediately on being laid, turning yellow, then orange; finally becoming greyish just before emergency of larva; surface shiny. L. 1.4 mm.; B. 1mm.

Habits.—This is the commonest species of *Euplœa* and may be seen everywhere throughout continental India at all times of the year, in the plains, in the hills, in grass-lands, jungles, on bare rocky slopes and in dark shady nallas, generally a few yards above the ground sailing along lazily in the characteristic danaine style or busily, if somewhat weakly, flying about in search of a suitable leaf or bud or twig whereon to deposit its egg. It should not be a difficult quest judging by the numerous foodplants the insect has to choose from. It has a range of three botanical families, *Urticaceæ*, *Apocynaceæ* and *Asclepediaceæ*. Its larva has been found upon *Streblus asper*, Lour., *Ficus bengalensis* L., *F. religiosa*, L., *F. glomerata*, Roxb., belonging to the first family: *Holarrhena antidysenterica*, Wall., *Nerium odorum*, Soland., *N. oleander*, L., *Ichnocarpus frutescens*, Br., of the second; and the Asclepiad creeper *Hemidesmus indicus*, Br.

8. **Euplœa kollari**, *Felder.*—The most ample-winged of our three species of the genus. Male and female *upperside* very dark olive-brown, paling towards outer margins; both wings with complete or nearly complete double series of submarginal white spots, the inner row the larger, decreasing in size on the forewing towards apex where it curves in; on the hindwing the row is of elongate-oval spots, much larger than the outer ones; these outer very regular, two in each interspace on forewing, obsolete towards apex. *Underside* olive-brown, spots as above, on forewing two to four extra ones on disc, that in interspace 2 largest, also a small costal spot; on the hindwing one or two discal spots. Antennæ very dark-brown, head, thorax and

abdomen the same, the former two speckled sparsely white.* Exp. 100-104mm.

Larva.—The caterpillar is very similar to that of *E. core* except that the front pair of tentacles are generally held curled which is never the case in the other species (where, however, the posterior pairs may be slightly curled at the tips). Spiracles oval, shiny black, placed in spiracular band: this band here pure white touched with yellow-orange, while in *core* it is yellow; tentacles flesh-coloured, often light pink, more or less deeply tipped black; belly a watery olive-brown-green of varying shades in different specimens: with some white spots; band on base of pseudolegs 7-10 and on base of true legs pure white (yellowish in *core*); there is a dark pulsating dorsal line. Changes to light green before pupation. L. 44mm.; B. 6 mm.; L. of tentacles of segment 3 : 10 mm. if not curled and 6mm. if curled.

Pupa.—Is the same exactly as that of *E. core* except that the constriction is less behind thorax because the abdomen is not so swollen at segment 7. It is generally larger than that of *core*. Spiracles same colour as pupa, longly oval. Colour is bright green suffused with gold through which the green is plainly visible; a small lateral black spot on thorax, segments 4, 6 and 11; a black streak on hinder margin of thorax, subdorsal; cremaster black and shiny; no other marks. L. 20mm; B. 97·5 mm. at segment 7=H. at same place; H. at apex of thorax, 8·25 mm.; B. at shoulders 7·25mm.

Habits.—The egg, larva and pupa are exactly the same as for *E. core*. The imago is particularly fond of damp places; affecting much the banks of nallas in the monsoon months. It is indeed nearly altogether a monsoon species as there are very few about in the dry months. It keeps to one place more than any of the species of the sub-family mentioned in these papers and does not seem to wander even in the districts where it occurs. It has the same distribution as *E. coreta* on the West coast of India but has been also recorded from Orissa and Bengal in the East. The insect is not rare at certain times of the year where it occurs. It may always be known on the wing from the other two by its larger size and the greyness of the costal region of the hindwing. The larva has been found on *Ficus hispida*, L., in Kanara and doubtless feeds on other kinds of Fig.

(*To be continued*).

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* The male has a short, broad (3mm. in width and length) silky band on forewing in usual place and a patch of scales near subcostal vein of hindwing where the wing is prominently grey.

PLANTS OF THE PUNJAB.

A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR.

BY

Lieut.-Colonel C. J. Bamber, I.M.S.,

Fellow of the Linnean Society.

Part II.

(*Continued from page 861, of Vol. XVIII*).

Erect Plants.

Trees.

Trees with Alternate Stipulate Lobed Leaves.

Petals Ununited.

Kydia calycina,
Pula.
Malvaceæ.
F. B. I. i. 348.
The Plains to 2,000 ft.

medium size; generally stellately downy leaves, sometimes simple, 4-5 by 3 in., rounded heartshaped midlobe longest, smooth or with few hairs above; stellate down beneath, leaf stalk 1-2 in.; flowers in many flowered branched bunches, white or pink; petals 5, exceeding the sepals in length, bracteoles 4-6 leafy, joined below, calyx 5 lobed, stamens joined into a tube of 5 segments.

Sterculia villosa,
Gulbodla, poshwa.
Sterculiaceæ.
F. B. I. i. 355.
The Plains.

large; bark grey, young parts tawny woolly, branches marked with large scars; leaves 12-18 in., long and broad, crowded at the end of branches, smooth above, woolly beneath, deeply palmately 5-7 lobed, lobes often cleft at the apex; leaf stalk about as long as the leaf, stipules large soon falling off, flowers in bunches 8-12 in., long, appearing before the leaves, yellow; calyx, of 5 lobes, yellow with pink or purple at the base; corolla, none; follicles 2-7 sessile, 1½-3 in. long, tapering at both ends, bright red when ripe, seeds oval, smooth.

Pterospermum acerifolium,
Kanakchampa.
Sterculiaceæ.
F. B. I. i. 368.
The Plains to 4,000 ft.

bark smooth, ashy; young branches and calyx covered with rusty wool; leaves 6-12 by 5-10 in., shallow lobes, smooth above, grey wool beneath; stipules with many points, soon falling off; leaf stalk, as long as the leaf; flowers white fragrant, 5 inches long, calyx of 5 segments, linear, sharply cut, petals 5

Trees with Alternate Stipulate Lobed Leaves.

Petals Ununited.

	linear, stamens joined into 20 threads, 15 with anthers 5 without ; capsule 2-6 in., long, woody, 5 angled brown wool outside, seeds winged.

Pod bearing. Leaves in 2 Lobes.

Bauhinia racemosa. Leguminosæ. F. B. I. ii. 276. The Plains.	small crooked tree, rough, bark with deep cracks; leaves, $1\frac{1}{2}$-2 in., broader than long, deeply split from the apex into two lobes ; petals pale .yellow. $\frac{1}{3}$-$\frac{1}{2}$ in. long, stamens 10, hairy, pod 6-12 by $\frac{1}{2}$-1 in., curved, stalk one inch long, seeds 12-20.
Bauhinia purpurea, Leguminosæ. F. B. I. ii. 284. The Plains.	medium size; bark ashy or brownish; young branches velvety; leaves, 3-6 in. long, a little longer than broad, split to the middle into two lobes ; petals, deep rose colour $1\frac{1}{2}$-2 in. long, with a long stalk, stamens 3-4.
Bauhinia variegata, *Kachnar.* Leguminosæ. F. B. I. ii. 284. The Plains to 3,000 ft.	medium size; bark as in the preceding; leaves, rather broader than long, 4-6 in. long; petals 2 in. long, with a long stalk, four white and one red, the white, often streaked with purple ; flowers fragrant, stamens 3-5

Not Pod Bearing.

Pyrus Pashia,	see Trees, Alternate, Stipulate, Simple.
Pyrus lanata, *Marphal.* Rosaceæ. F. B. I. ii. 375. Himalaya, 8-10,000 ft. Simla, Jako, Narkanda (Collett).	small ; leaves lobulate, finely toothed, 5-0 by 2-4, in., white woolly beneath, flowers $\frac{1}{2}$ in., diam., stalks, short woolly sepals 5, petals 5, stamens many ; fruit $\frac{1}{2}$-$1\frac{1}{2}$ in. diam., tinged with red, 2-3 seeded, pear shaped or globose.
Crataegus Oxyacantha, Hawthorn, *Phindak.* Rosaceæ. F. B. I. ii. 383. Himalaya, West of the Chenab, 6-9,000 ft. Murree.	small ; branches with spines ; leaves 1-2 in., wedge shaped at the base, 3-5 lobed, lobes sharply toothed towards the tip : stipules leafy soon falling off ; flowers $\frac{1}{2}$ in. diam., white, odorous, sepals 5, petals 5, stamens many ; fruit, scarlet, 2-3 stones.

TREES WITH ALTERNATE STIPULATE LOBED LEAVES.

PETALS UNUNITED.

Crataegus Clarkei, ROSACEÆ. F. B. I. ii. 383. Kashmir, 8,000 ft.	small; softly woolly; leaves 2-4 in. oblong, base wedge shaped, segments oblong toothed at the broad tip, stipules very large, semi-circular and curved, toothed; flowers less than $\frac{1}{2}$ in. diam., sepals 5, petals 5, stamens many; fruit green, $\frac{1}{4}$ in. diam., 5 seeded with 5 ridges.

PETALS NONE.

Fruit, a Compound Berry.

Morus alba,	see Trees, Alternate, Stipulate, Simple.
Morus indica, F. B. I. v. 492.	see Trees, Alternate, Stipulate, Simple.
Morus serrata,	see Trees, Alternate, Stipulate, Simple.

Flowers on long stalked Globose Heads.

Platanus orientalis, *Chenar.* PLATANACEÆ. F. B. I. v. 594. Himalaya West of the Sutlej, 4-8,000 ft.	large; bark flaky whitish green and smooth beneath; leaves 6-9 in. diam., usually broader than long, palmately 3-5 lobed, lobes irregularly toothed, stipules on shoots leafy and lobed; heads 1-1$\frac{1}{2}$ in. diam., 2-3 on one stalk, male without bracteoles, female with bracteoles; ripe carpels with pyramidal tips, seeds linear.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Bombax malabaricum, **Silk cotton tree,** *Semel.* MALVACEÆ. F. B. I. i. 349. The Plains to 6,000 ft. Simla (Collett).	large; trunk more or less buttressed, branches and young stem covered with conical prickles; leaves digitate 5-7 leaflets; flowers appearing before the leaves 4-5 in. across, crimson or yellow, calyx leathery, silky felted within, petals 2-3 in. long, felted with star-shaped hairs, stamens many, joined below into a tube; capsule, 5-7 in. long, oblong, downy, green; seeds smooth covered with silky wool.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

POD BEARING.

Pinnate with 3 Leaflets.

Ougeinia dalbergioides, *Sandan.* LEGUMINOSÆ. F. B. I. ii. 161. The Plains to 4,000 ft. Sutlej Valley (Collett).	medium size ; round grey branches ; leaves 6-12 in. long, polished green above, end leaflet 3-6 in. long ; flowers, whitish or pale pink, calyx $\frac{1}{10}$ in. long, corolla $\frac{1}{4}$ in. long ; pods, flat, jointed, 2-4 by $\frac{1}{4}$ in., seeds 2-5, $\frac{1}{5}$ in. diam., smooth, brown, flat.
Erythrina indica, Indian coral tree, *Pangra.* LEGUMINOSÆ. F. B. I ii. 188. The Plains to 4,000 ft. Sutlej Valley (Collett).	medium size ; grey bark, branches prickly, prickles usually black ; leaflets broad ovate ; leaves appear after the flowers, flowers coral red, $2\frac{1}{2}$ in. long in bunches 6 in. long or more ; calyx bell shaped, 5 toothed, petals 2 in. long, standard large, wing and keel small, stamens 10, upper one often ununited, pod $\frac{1}{2}$ to 1 ft. long, cylindrical with contractions ; seeds 6-8.
Erythrina suberosa, *Dhauldhak.* LEGUMINOSÆ. F. B. I. ii. 190. The Plains to 4,000 ft.	medium size ; corky, deeply cracked bark, yellowish, prickles yellow, leaves appear after the flowers, leaflets broad ovate ; flowers coral red, $1\frac{1}{2}$-2 in. long, calyx top shaped, 2 lipped ; pod $\frac{1}{2}$ ft. long cylindrical narrow, seeds 2-4.
Butea frondosa, *Dhak.* LEGUMINOSÆ. F. B. I. ii. 194. The Plains to 4,000 ft.	small crooked tree with stout trunk ; leaflets 4-8 in. long ; flowers 2-3 in. long, orange red in axillary or terminal racemes, calyx $\frac{1}{2}$ in. long, brown velvety, petals white woolly over the orange red ; pods, 4-8 in. by $1\frac{1}{2}$-2 in., seeds 1 in upper part of pod. This tree yields an astringent gum like kino, also lac and lac dye.

Pinnate with 3-5 Leaflets.

Dalbergia Sissoo, *Shisham, Tali.* LEGUMINOSÆ. F. B. I. ii. 231. The Plains to 4,000 ft.	large ; bark grey, furrowed vertically flaking in narrow strips ; leaves 4-5 in. long, leaflets alternate ovate, long pointed ; flowers, $\frac{1}{5}$-$\frac{2}{5}$ in. long, whitish yellow, in small branching racemes, stamens 9 ; pods 2-3 in. by $\frac{1}{4}$-$\frac{1}{2}$ in., seeds $\frac{1}{4}$ in. long, kidney shaped· 1-3. This tree yields excellent timber.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

POD BEARING.

Pinnate with 5-many Leaflets.

Pongamia glabra, *Papar.* LEGUMINOSÆ F. B. I. ii. 240. The Plains to 3,000 ft.	medium size; bark greyish green; leaves 8-10 in. long, leaflets 5-7, 2-4 in. long, flowers $\frac{1}{2}$ in. long, whitish tinged with violet or pink in axillary racemes; pod $1\frac{1}{2}$-2 in. long, $\frac{1}{3}$-$\frac{1}{4}$ in. thick woody, with a curved point; seed 1, 1 in. diam. Oil from the seeds is used for lighting and as a cure for skin diseases.

Leaves Bipinnate.

Cæsalpinia, or Poinciana pulcherrima, *Krishnachura.* LEGUMINOSÆ. F. B. I. ii. 255. The Plains.	small; prickles, on branches few and scattered; pinnæ 12-18, leaflets on the pinnæ 20-24; flowers large, scarlet yellow, calyx 5 cleft to base, petals 5, nearly equal, stamens 10, pod nearly straight, 2-3 in. long, narrow and thin, seeds 6-8.
Parkinsonia aculeata, *Vilayati kikar.* LEGUMINOSÆ. F. B. I. ii. 260. The Plains to 3,000 ft	small; sharp woody spines, the remains of the leaf stalks of bipinnate leaves with 2-6 pinnæ in the axils of two stipulate thorns, leaves bipinnate, pinnæ $\frac{1}{2}$-1 ft. long, stalks much flattened with or without minute leaflets; flowers yellow $\frac{1}{2}$ in. diam. in short racemes, calyx lobes nearly equal, petals equal, pods, 3-4 in. long, like a necklace of beads. A native of Tropical America.

Leaves Pinnate.

Cassia Fistula, Indian Laburnum, *Amaltas.* LEGUMINOSÆ. F. B. I. ii. 261. The Plains to 3,000 ft.	small; leaves 1 ft. long, leaflets 2-6 in. long, stipules minute, racemes as long as the leaves pendulous; flowers 1 in. long, yellow, petals broad, nearly equal, stamens 20; pods, 1-2 ft. long, cylindrical, 1 in. thick, seeds many, embedded in sweet blackish pulp, purgative.
Tamarindus indica, Tamarind, *Imli.* LEGUMINOSÆ. F. B. I. ii. 273. The Plains.	large; leaves 3-6 in. long, leaflets $\frac{1}{2}$ in. long 20-30; flowers pale yellow streaked with red in racemes, calyx teeth 4, petals 3, $\frac{1}{2}$ in. long, stamens 3; pods, 3-8 by 1 in., leathery flattened, seeds, $\frac{1}{2}$ in. diam. embedded in brown pulp, brown, shining.

Trees with Alternate Stipulate Compound Leaves.

Petals Ununited.

Pod bearing.

Leaves Bipinnate

Flowers Minute.

Prosopis spicigera,
Jand.
Leguminosæ.
F. B. I. ii. 288.
The Plains.

medium size, with extremely long tap root scattered broad conical nearly straight, prickles $\frac{1}{8}$-$\frac{1}{4}$ in. long ; pinnæ 4, 1-2 in. long with a gland between each pair, leaflets 8-12 pairs, $\frac{1}{4}$-$\frac{1}{2}$ in. long ; flowers yellow, in spikes, 2-3 in. long, calyx minute 5 toothed, petals 5, stamens 10 : pods, 5-10 in. long cylindrical with contractions at intervals, edible, seeds in mealy pulp, oblong.

Prosopis Stephaniana,
Chogak.
Leguminosæ.
F. B. I. ii. 288.
The Plains near Peshawar.

small ; copious slender prickles, leaflets smaller than the last ; flowers rather larger ; pods, $\frac{1}{2}$-1 in. long, $\frac{1}{2}$ in. thick, otherwise like the last species.

Flowers minute in Round Heads ; Spines Long and Straight.

Acacia Farnesiana,
Vilayati kikar.
F. B. I. ii. 292.
The Plains to 3,000 ft.

small ; slender zigzag branches with grey dots ; leaf stalk 1-1$\frac{1}{2}$ in. long with 2 straight, stipular thorns, pinnæ 4-8 pairs, 1-1$\frac{1}{2}$ in. long ; leaflets 10-20 pairs $\frac{1}{4}$ in. long ; flowers bright yellow, fragrant, heads less than $\frac{1}{2}$ in. diam. ; pod, 2-3 in. long, $\frac{1}{2}$ in. thick, cylindrical, sutures straight ; seeds in two series in pulp.

Acacia Arabica,
Babul kikar.
F. B. I. ii. 293.
The Plains.

small : finely grey downy branchlets, spines stipular, straight $\frac{1}{4}$-2 in. long ; leaves 1-2 in. long, pinnæ 3-6 pairs, $\frac{1}{2}$-1$\frac{1}{2}$ in. long, leaflets, 10-20 pairs, $\frac{1}{8}$-$\frac{1}{4}$ in. long, heads, $\frac{1}{2}$ in. diam. ; flowers yellow, fragrant ; pods usually solitary, 3-6 in. long, straight, stalk $\frac{1}{2}$-$\frac{3}{4}$ in. long, sutures deeply indented between each seed, grey downy, 8-12 seeded.

Acacia eburnea,
Pahari kikar.
Leguminosæ.
F. B. I. ii. 293.
The Plains.

small ; general habit of the last but differs by its leaves having fewer leaflets, 12-16, its flower having an unpleasant smell and its straight sutured pod, profusely veined, smooth, 6-10 seeded, generally 2-4 pods from one flower head.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

POD BEARING.

Acacia Jacquemontii,
LEGUMINOSÆ.
F. B. I. ii. 293.
The Plains.

small; general habit, of the last but the pod is thin, broad, flat, smooth with straight sutures, grey, 2-3 in. long, 5-6 seeded with a stalk $\frac{1}{4}$-$\frac{1}{2}$ in. long.

Acacia leucophlœa,
Rinj, raeru.
LEGUMINOSÆ.
F. B. I. ii. 294.
The Plains.

readily recognised from all the above by its branched racemes of flowers.

Flowers minute in Spikes, Spines, Short and Hooked.

Acacia Catechu,
Khair, Kutch.
LEGUMINOSÆ.
F. B. I. ii. 295.
The Plains to 3,000 ft.

medium size; bark brown, hangs down in long strips; spines brown in pairs, short curved; leaf stalk, 3-4 in. long, often prickly, pinnæ 20-40 pairs, leaflets, 30-50 pairs, $\frac{1}{4}$ in. long, linear; flowers pale yellow; pod, 2-3 in. long, straight, flat, dark brown, shining, 5-6 seeded.

Acacia Senegal,
Khor, kumta.
LEGUMINOSÆ.
F. B. I. ii. 295.
The Plains, Rohtak.

small; flexuose grey branches; spines small often in threes, hooked or straight, polished and black: pinnæ, 3-5 pairs, leaflets, 8-14 pairs; flowering spikes, white, fragrant, 2-3 in. long, longer than the leaves calyx bell-shaped, teeth angular, stamens yellow; pod, 3 in. long, $\frac{3}{4}$ in. broad straight, thin, somewhat depressed between the 4-6 seeds.

Acacia Modesta,
Phulahi.
LEGUMINOSÆ.
F. B. I. ii. 296.
The Plains to 4,000 ft.
Suni (Collett).

medium size; grey smooth branches; spines stipular in pairs hooked, stout, dark brown, polished. pinnæ, 2-3 pairs; leaflets, 3-5 pairs; flowers white or pale yellow, fragrant in drooping spikes; pod, 2-3 in. long, straight, flat, smooth, glossy narrowed to a short stalk, 3-5 seeded.

Flowers in Round Heads.

Albizzia Lebbek,
Siris, Sirsa.
LEGUMINOSÆ.
F. B. I. ii. 298.
The Plains to 5,000 feet.
Valleys below Simla (Collett).

large; bark grey; leaves, 3-12 in. long; pinnæ, 4-8, leaflets 1-1$\frac{1}{2}$ in. long, 6-20 pairs on each pinnæ obtuse; flower heads, 1$\frac{1}{4}$ in. across, white, fragrant, on stalks 2-4 in. long in clusters of 2-4, stamens long, rose colour, many, protruding like a shaving brush; pods, 4-12 in. long by 1-2 in. broad, blunt at both ends, flat, smooth, straw coloured; seeds, 4-12.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.
PETALS UNUNITED.
POD BEARING.

Flowers minute in Round Heads.

Albizzia odoratissima, *Kali Siris.* LEGUMINOSÆ. F. B. I. ii. 299. The Plains to 3,000 ft.	medium size; bark dark grey; leaves, 6-12 in. long, pinnæ 3-4 pairs, 5-8 in. long; leaflets 8-20 pairs on each pinnæ, $\frac{3}{4}$-1 in. long, obtuse; heads small, few flowered arranged in a terminal branched raceme; flowers $\frac{3}{4}$-1 in. across, of which nearly all consisting of yellow stamens, yellowish-white, fragrant; pod 6-9 inches, about 1 inch, broad, thin, reddish brown, 8-12 seeded.
Albizzia procera, *Safed Siris.* LEGUMINOSÆ. F. B. I. ii. 299. Base of Himalaya.	large; bark yellowish or greenish-white, smooth peeling off in thin flakes; leaves 10-15 in. long, pinnæ 3-5 pairs, 6-9 in. long: leaflets 6-12 pairs on each pinnæ: heads, small $\frac{1}{2}$ in. diameter, 15-20 flowered in clusters of 2-5 on terminal branched racemes 12-24 in. long, flowers yellowish white, $\frac{1}{4}$ in. long, stamens $\frac{1}{5}$ in. long; pods 4-6 in. long by $\frac{1}{2}$-$\frac{3}{4}$ in., smooth, brown, 8-12 seeded.
Albizzia Julibrissin, var. Mollis, *Lalsiris, brind.* LEGUMINOSÆ. F. B. I. ii. 300. Himalaya to 6,000 feet. Suni (Collett).	medium size; bark dark grey, smooth, with long horizontal wrinkles; leaves 6-12 in. long, pinnæ 6-12 pairs, 3-5 in. long, leaflets 10-25 pairs, $\frac{1}{6}$-$\frac{1}{4}$ in. long, narrow, sensitive; heads round, not on branched racemes, flowers pink, 1-1$\frac{1}{2}$ in. long, consisting chiefly of stamens; pod 3-5 in. long by $\frac{1}{2}$-$\frac{3}{4}$ in. linear, thin, 8-12 seeded.
Albizzia stipulata, *Siran.* LEGUMINOSÆ. F. B. I. ii. 300. Himalaya to 4,000 ft. Below Sipi (Collett).	medium size; bark grey, with short vertical wrinkles crossed by deeper horizontal cracks; stipules large, sharp pointed; leaves 7-12 in. long, pinnæ 6-16 pairs, 4-6 in. long, leaflets 20-40 pairs, $\frac{1}{4}$-$\frac{1}{2}$ in. long, tapering from the broad base; heads in branched racemes; flowers odourless, yellowish white, stamens tinged with red; pod 5-6 in. long by $\frac{3}{4}$-1 in., pale brown, 8-10 seeded.
Pithecolobium dulce, *Vilayati imli.* LEGUMINOSÆ. F. B. I. ii. 302. The Plains.	small; leaves and branches, smooth; stipules, spinous minute, pointing upwards; pinnæ, 2, leaflets 2, 1-2 in. long, obtuse; heads dense, $\frac{3}{8}$-$\frac{1}{2}$ in. broad in long branched racemes of minute white flowers, pod, twisted when ripe into a circle, 4-5 in. long indented between the seeds, which are embedded in white pulp, sweet, edible.

TREES WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

NOT POD BEARING.

Fruit Round or Pear-shaped.

Pyrus Aucuparia, Rowan, Mountain Ash,
Battal, rungrek.
ROSACEÆ.
F. B. I. ii. 375.
Himalaya, 11-13,000 ft.
Hattu (Collett).

small; young parts with white cottony wool, sometimes persisting on stalks of leaves and flowers; leaves pinnate, 4-6 in. long, leaflets 15-25, ½-2 in. long, sharply toothed, white beneath; flowers pink, ⅓-½ in. diam. crowded in branching clusters nearly at the same level, petals 5, stamens many, styles 2-5, base woolly; fruit, red; round, ⅓-½ in. diam., crowned with the persistent calyx.

Pyrus foliolosa,
Sulia, hulia.
ROSACEÆ.
F. B. I. ii. 376.
Himalaya, 9-12,000 ft.
Hattu (Collett).

small; hairy red brown down on leaf and flower stalks; leaves pinnate, 4-6 in. long, leaflets 20-30, 1-1½ in. long, sharply toothed; flowers greenish-white, smell unpleasant, ¼ in. diam.. crowded in downy branching clusters with linear bracts, nearly at the same level, petals 5, stamens many, styles 2-5; fruit, round or ovoid, red with blue bloom, ¼-½ in. diameter.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Cocculus laurifolia,
Tilphara.
MENISPERMACEÆ.
F. B. I. i. 101.
Himalaya to 5,000 ft.
Suni (Collett).

small; branches hanging down, angled, branchlets bearded at the base; leaves 3-6 in. long, dark green, tapering from both ends, shining; flowers in racemes with branching stalks, shorter than the leaves, minute, sepals 6 in 2 series of 3, petals 6, 2 lobed, stamens 6; drupe minute, black, ⅙ in. diam., generally 3, depressed laterally, stone horseshoe shaped, keeled and with tubercles.

Tamarix articulata,
Farash.
TAMARISCINEÆ.
F. B. I. i. 249.
The Plains.

small; looks something like a fir, branches jointed; leaves, minute pressed against branch, apex triangular scale like, sheathing, often white with saline efflorescence, flowers in slender spikes collected in terminal branching racemes, pink, ⅛ in. diam., sepals and petals 5, stamens 5; capsule 3-5 valved, seeds small with a tuft of long hairs.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Citrus Aurantium, Orange, *Naringi.* RUTACEÆ. F. B. I. i. 515. The Plains to 2,000 ft.	small ; young shoots greenish-white, usually spinous; leaves, really of one leaflet jointed to the leaf stalk, which is often winged, they appear to be simple leaves, but are really compound, the other leaflets having been suppressed, gland dotted, edges finely toothed, 2 in. long, flowers pure white, sweet scented ; fruit, round, flattened at both ends, orange, rind thin, loose, pulp sweet.
Citrus decumana, Shaddock, Pumelo, *Chako'ra.* RUTACEÆ. F. B. I i. 516. The Plains.	small ; young shoots downy, and usually spinous ; leaves 6-9 in. long, stalk broadly winged ; flowers large, white, strongly scented ; fruit very large, 5 in. diam. round or pear-shaped ; rind very thick, pulp yellow, pink or crimson, sweet or acid.
Meliosma dilleniaefolia, *Kanna, karkon.* SABIACEÆ. F. B. I. ii. 4. Himalaya, 4-8,000 feet. Simla (Collett).	small ; branches, leaf and flower stalks covered with rusty down ; leaves 6-12 by 3-5 in. margin sharply toothed rough with minute dots above abruptly pointed ; flowers stalked, minute, white, loosely scattered in branching racemes with bracts sepals 5, concave, petals 5, 3 outer concave, orbicular, 2 lobed, stamens 5, two with anthers, three without, fruit round, $\frac{1}{8}$ in. diam., black, one stone.
Meliosma pungens, *Kopp r, bukesh.* SABIACEÆ. F. B. I. ii. 4. Himalaya, 3-8,000 ft. Narkanda (Collett).	small ; branches, leaf and flower stalks covered with rusty down ; leaves 5-9 by 2-3 in., margin toothed with distant large teeth, long pointed ; flowers larger than the last, white small, sessile closely packed on branching racemes, bracts soon falling, bracteoles 1 or 2 below the sepals ; fruit, $\frac{1}{3}$ in. diam. round
Mangifera indica, Mango, *Am.* ANACARDIACEÆ. F. B. I. ii. 13. The Plains to 3,000 ft.	large ; smooth except flower stalks ; leaves 6-16 in. long, shining, margin smooth, crowded at the end of branches, stalk 1-4 in. long, swollen at the base ; flowers yellow, fragrant, in branched downy racemes, calyx lobes 4-5, soon falling off, petals 5, with 3 ridges, stamens 4-5, one much the largest ; fruit, large, yellow, fleshy, flattened lengthwise ; stone, fibrous, large.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Semecarpus Anacardium, Marking nut tree,
Bhilawa.
ANACARDIACEÆ.
F. B. I. ii. 31.
The Plains to 3,500 ft.

medium size ; bark exudes a dark acrid juice young parts, leaf stalks, under surface of leaves and flower stalks covered with pale velvety down ; leaves 9-30 by 5-12 in., flat, leathery, oblong, tip rounded, margin cartilaginous, stalk, 1-2 in., clustered at the end of branches ; flowers greenish-white, $\frac{1}{4}$-$\frac{1}{3}$ in. diam., in erect terminal branching racemes, calyx 5 lobes, petals 5, stamens 5-6 ; bracts lanceolate ; fruit 1 in. long, ovoid, smooth, black in a fleshy orange-red cup, seed one. The acrid juice of the fruit is used for blistering and to simulate bruises, also to mark linen.

Barringtonia acutangula,
Samundar phal, Jujar.
MYRTACEÆ.
F. B. I. ii. 508.
The Plains.

small ; leaves 5 by 2 in. crowded at the ends of branches, short stalked, minutely toothed ; flowers deep pink in long hanging racemes, racemes often 1 ft. long, calyx lobes 4, petals 4 or 5, small, stamens red, far protruding, many ; fruit 1-1$\frac{1}{2}$ by $\frac{1}{2}$-$\frac{3}{4}$ in. four angled, equally narrowed to each end, crowned by the calyx, seed one, ovoid, 1 in. long.

Careya arborea,
Kumbi.
MYRTACEÆ.
F. B. I. ii. 511.
The Plains to 4,000 ft.

medium size ; bark dark grey, peeling in narrow strips ; leaves 6-12 by 3-6 in. broad rounded at the apex, smooth, minutely toothed ; flowers 3-4 in. diam. scattered on spikes, calyx bell shaped lobes, ovate 4, petals 4, 1$\frac{3}{4}$ in. long, white, soon falling off, stamens red, many in several series ; fruit round, 2-3 in. diam., crowned by a pit with the calyx teeth round it, seeds $\frac{3}{8}$-$\frac{1}{4}$ in., oblong with rounded ends.

Marlea begoniæfolia, see Trees, Alternate, Exstipulate, Lobed.

Cornus macrophylla, see Trees, Opposite, Exstipulate, Simple.

Cornus oblonga, see Trees, Opposite, Exstipulate, Simple.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Pieris ovalifolia, *Ailan.* ERICACEÆ. F. B. I. iii. 460. Himalaya 3-8,000 ft. Simla (Collett).	small ; bark thick deeply furrowed, peeling in narrow flakes ; leaves 3-7 by 1-4 in., ovate, smooth, flowers $\frac{1}{5}$-$\frac{1}{3}$ in. long white bell-shaped, bracteolate in narrow bracteate racemes, 4-10 in. long, calyx teeth 5, triangular, corolla lobes 5 recurved ; stamens 10, with 2 filiform tails, capsules $\frac{1}{6}$ in., round, smooth, splitting into five valves, seeds minute, many, linear oblong.
Rhododendron arboreum, *Burans.* ERICACEÆ. F. B. I. iii. 465. Himalaya, 5-10,000 ft. Simla (Collett).	small ; bark reddish brown, thick, furrowed, peeling in narrow flakes ; leaves 5 by $1\frac{1}{4}$ in., often clustered at the end of branches, oblong, narrowed at both ends pointed, whitish, felted beneath, sometimes brown, flowers 1-$1\frac{1}{2} \times \frac{3}{4}$-$1$ in., red, widely opened in dense clusters, calyx lobes $\frac{1}{10}$ in. wide, ovate, corolla bell shaped, lobes 5, stamens 10, fruit, a capsule, $1 \times \frac{1}{3}$ in., cylindrical, curved with longitudinal ridges.
Mæsa indica, MYRSINACEÆ. F. B. I. iii. 509. The Plains to 6,000 ft. Amballa district, Simla (McIntire).	small : branches long and straggling ; leaves 5 by $1\frac{3}{4}$ in., leathery, pointed, margin toothed : flower white, small in branched racemes, calyx lobes 5, blunt, corolla 5 lobed twice the size of the calyx stamens 5, short : fruit a round berry about the size of a pepper corn, fleshy, juicy, pinkish white when ripe, crowned with the calyx, seeds many, hollowed out at the base.
Reptonia buxifolia,	see Shrubs, Alternate, Exstipulate, Simple.
Mimusops elengi, *Maulsiri.* SAPOTACEÆ. F. B. I. iii. 548. The Plains.	large ; young shoots, flower stalk and outside of calyx covered with rusty velvet ; leaves $3\frac{1}{2}$ by $1\frac{3}{4}$ in. smooth, short pointed, usually crowded at the end of branchlets ; flowers white, fragrant, in clusters, calyx with 8 segments in two series, corolla lobes 16-20 in two series, narrow pointed, stamens 8, staminodes 8, all hairy ; berry $\frac{3}{4}$-1 in., ovoid, one, rarely two seeded, yellow, edible.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Mimusops hexandra, *Kirni.* SAPOTACEÆ. F. B. I. iii. 549. The Plains.	large: leaves 3-4 by 1½-2 in., scattered leathery, smooth, dark green, broad tip, apex notched or rounded; flowers whitish yellow ¼ in. across, calyx segments 6, corolla lobes 16-20, stamens 6-8, staminodes 6-8, smooth, often two pointed, in short stalked clusters along the branches as well as at the ends; berry ½ by ¼ in., one, rarely two seeded, edible.
Diospyros montana, *Bistendu.* EBENACEÆ. F. B. I. iii. 555. The Plains east of the Ravi river.	medium size; often spinous on branches, bark pinkish or bluish grey, thin and smooth on branches, on trunk almost black, deeply cracked; leaves 2-4 by 1-1½ in., light green, ovate, soft, velvety or smooth; flowers white, male in clusters, female solitary, larger than the male, calyx lobes 4, blunt, velvety on both sides, petals 4, stamens 16 in 8 pairs; fruit round ½-1 in. diameter, yellow supported by the leathery enlarged calyx, has an unpleasant smell, bitter, seeds embedded in pulp.
Diospyros Lotus, *Amlok.* EBENACEÆ. F. B. I. iii. 555. West Punjab, Hazara, 3-6,000 ft.	resembling the last, but the leaves are larger 6 by 2 in., the fruit is eaten, dark purple, round or ovoid, sweet.
Symplocos cratægoides, *Ludh, lodar.* STYRACEÆ. F. B. I. iii. 573. Himalaya, 2-8,000 ft. Narkanda (Collett).	small; bark light grey, corky with long vertical furrows; leaves 2-4 by 1-1½ in., ovate, long pointed, minutely toothed with a black tip to each tooth, turning yellow when dried; bract one, bracteoles 1-3; flowers white, sometimes yellow, fragrant, ⅕ in. diam., in terminal branching racemes, 1-5 in., calyx bell shaped, lobes 4-5, corolla 5, cleft nearly to the base, stamens many in 5 bundles; fruit drupaceous, ovoid ¼ in. long, crowned with the calyx, usually one seeded. This plant yields a yellow dye.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Plumeria acutifolia, Frangipani tree, *Gulchin.* APOCYNACEÆ. F. B. I. iii. 641. The Plains to 2,000 ft.	small; branches thick and fleshy, juice milky leaves at the end of branches; leaves 6-15 in. oblong, acute at both ends; flowers 2-3 in. diam. in terminal clusters of 2-3, white with yellow centre, fragrant, calyx 5 lobed, corolla tubular below, flat and spreading above; fruit a follicle 5 in. long, cylindric; seeds oblong, winged.
Cordia Myxa, *Lasura.* BORAGINACEÆ. F. B. I. iv. 136. The Plains to 5,000 ft. Valleys below Simla (Collett).	small; bark grey or brown with shallow longitudinal wrinkles; leaves 3-6 by 2-4 in. broad ovate, leathery, smooth above and below except when young stalk 1-2 in. long; flowers white, small, in clusters of 2-8 in., calyx teeth 4-5, petals 5 united below stamens 4-8, hairy; berry, yellow or pinkish, glossy when ripe, edible, one stone rough, hard in viscid sweetish pulp, used for bird lime and as a cure for coughs.
Cordia obliqua, *Chota lasura.* BORAGINACEÆ. F. B. I. iv. 137. The Plains.	small; shoots yellow hairy; otherwise like the last, but flowers a little larger, fruit edible.
Cordia Rothii, *Gondi.* BORAGINACEÆ. F. B. I. iv. 138. The Plains.	small; leaves 4 by $1\frac{1}{4}$ ins., nearly opposite, oblong, narrowed at the base, stalk $\frac{3}{4}$ in.; flowers smaller than C. Myxa and in smaller clusters, petals 4: fruit usually one seeded, edible.
Cordia vestita, *Kumpaiman, Kumbi.* BORAGINACEÆ. F. B. I. iv. 139 Himalaya 1-4,000 ft.	small; shoots yellow woolly, bark greenish grey smooth, peeling in large pieces, leaves 3-6 by $2\frac{1}{2}$-3 in., broad, long pointed, leathery, velvety beneath till mature: flowers yellowish-white in dense clusters, corolla lobes $\frac{1}{3}$ in.: fruit $\frac{3}{4}$ in. long, oblong, sharp pointed.
Ehretia acuminata, *Puna.* BORAGINACEÆ. F. B. I. iv. 141. The Plains to 5,000 ft.	medium size; trunk deeply grooved, bark brown with longitudinal cracks; leaves 3-5 by $1\text{-}2\frac{1}{2}$ in., oblong, pointed small toothed, smooth, leathery; flowers white, fragrant, small, in large branching clusters at the end of branches, calyx 5 lobed, persistent, corolla 5 lobed, rotate, stamens 5; drupe $\frac{1}{8}$-$\frac{1}{6}$

in. diam., short, obtuse, edible, red or black, not ribbed with two stones, one or two seeded.

Ehretia lævis,
Chamror.
BORAGINACEÆ.
F. B. I. iv. 141.
The Plains to 3,000 ft. Sutlej Valley, Basantpur (Collett).

medium size; bark smooth, grey; leaves 5 by $2\frac{1}{4}$ in., margin even, ovate oblong; flowers in one sided slender spikes not always at the end of branches, $\frac{1}{4}$ in. diam., white, calyx 5 cleft, corolla 5 lobed, spreading, stamens 5; fruit a drupe $\frac{1}{5}$ in. diam., depressed, round, red, four ribbed with one to four one-seeded stones.

Bridelia retusa,
Pathor, mark.
EUPHORBIACEÆ.
F. B. I. v. 268.
Himalaya, 2-3,500 ft.

small; bark thin, grey or brownish black; spinous when young; leaves 3-6 in. long, very leathery, oblong; flowers small, yellow, in clusters on long spikes, bracts small hairy, calyx 4-5 lobed, petals 5, in male flowers stamens 5 united below, in female flowers styles 2 with 2 branches each; fruit $\frac{1}{4}$ in. diam., round, purple black when ripe, resting on the flower, fruit edible, sweet, one stone.

Bridelia montana,
Gondni, kargnalia.
EUPHORBIACEÆ.
F. B. I. v. 269.
Himalaya, East of the Jhelum river 2-3,000 ft.

small; bark dark grey, branchlets often dotted with warts; leaves 3-6 in. long, blunt or sharp pointed, shining above, ovate; flowers small greenish yellow in axillary clusters, male and female together, bracts many, crowded, velvety, calyx lobes 5, sharp pointed, petals 5, round, shortly stalked, male flowers stamens 5 united below, female flowers styles 2 with 2 branches each; fruit size of a pea, ovoid or round, black when ripe seated on the calyx, stones usually 2.

PETALS NONE.

Flacourtia Ramontchi, var, occidentalis,
Katai, kukai.
BIXACEÆ.
F. B. I. i. 193.
Low hills to 3,000 ft. Suni (Collett).

small; more or less softly downy; spinous; leaves 1-2 in. long, broad and rounded; flowers small, yellow, in simple or branched racemes, sepals 4-5, small, petals none, stamens many; drupe $\frac{1}{3}$ in. diam., red or black, edible, stones minute 8-16 in two tiers.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Xylosma longifolium, *Chirunda.* BIXACEÆ. F. B. I. i. 194. Low hills to 5,000 ft. Sutlej Valley Suni (Collett).	small ; branches long, slender, thorny when young, wood scented, leaves 4-9 by $1\frac{1}{2}$-2 in., shining, leathery, toothed, long pointed ; flowers $\frac{1}{8}$ in. diam., yellow, female flowers clustered usually in short racemes only $\frac{1}{3}$ in. long scattered along the branches, male flowers many clustered in long racemes, stamens many, longer than the sepals, sepals 4-5, ovate, petals none ; berry dry, smooth, $\frac{1}{6}$ in. diam., red or black, 2-8 seeded.
Terminalia Catappa, The Indian Almond, *Janglibadam.* COMBRETACEÆ. F B. I. ii. 444. The Plains.	large ; trunk buttressed, leaves turn crimson before falling, branches in horizontal circles ; leaves 6-8 in. long, stalk short, base of leaves very narrow, flowers in spikes, calyx teeth 5, smooth, stamens 10, protruding, no petals ; fruit 1-$1\frac{1}{2}$ in., fleshy compressed showing two ridges, not velvety, stone one, kernel edible.
Terminalia belerica, *Bahera.* COMBRETACEÆ. F. B. I. ii. 445. The Plains.	large ; bark uneven bluish or ashy-grey with longitudinal furrows, leaves crowded towards the ends of branches, 3-6 in. long, stalk 1-3 in. long, flowers in spikes, very small, no petals, pale white or greenish-yellow with an unpleasant smell, calyx with 5 teeth soon falling, stamens 10, far protruding ; fruit 1 in. long, fleshy velvety, when dry shows five ridges ; seed bony thick. Fruit called Myrobolan and used for tanning and as a purgative.
Terminalia Chebula, *Harh, hararh.* COMRETACEÆ. F. B. I. ii. 446. The Plains.	large ; bark dark brown, young parts covered with rusty brown hairs ; leaves nearly opposite, 3-6 in. long, ovate, short pointed ; flowers $\frac{1}{10}$ in. diam., dull white in clustered spikes, strong scented, no petals, calyx teeth 5, hairy within, stamens 10 far protruding, fruit 1-2 in. long, fleshy, smooth, five-ribbed when dry, nut rough with grooved surface, kernel edible ; the fruit of this tree is called Myrobolan and used for tanning and as a purgative.
Terminalia Arjuna, *Arjun.* COMBRETACEÆ. F. B. I. ii. 447. The Plains.	large ; trunk buttressed, bark smooth grey ; young parts covered with rusty down, leaves nearly opposite, 5-8 in. long, oblong, short pointed ; flowers dull yellow in branching spikes, no petals, calyx teeth 5, smooth, broad ; fruit 1-2 in. long with 5-7 hard leathery narrow wings.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Terminalia tomentosa, *Asaina, sain.* COMBRETACEÆ. F. B. I. ii. 447. The Plains.	large ; bark deeply cracked, dark grey or black, peeling off in thick rectangular pieces, inner bark reddish brown, young parts covered with rusty velvety down ; leaves nearly opposite, 4-8 in. long smooth above, woolly beneath ; flowers dull yellow $\frac{1}{10}$ in. diam., calyx woolly, in spikes, bracts lanceolate, longer than buds, no petals ; fruit $1\frac{1}{2}$-$2\frac{1}{2}$ in. long with broad wings, striated ; the fruit is used as in the former species of Terminalia.
Anogeissus latifolia, *Bakli, Dhau,* COMBRETACEÆ. F. B. I. ii. 450. The Plains to 3,000 ft.	small ; bark greyish-green, smooth ; young parts, covered with rusty velvety down, leaves 2-4 in. long broad, rounded at both ends, smooth when old ; flowers in round heads, small, heads $\frac{1}{2}$ in. diam., in racemes, calyx tube long, teeth 5, soon falling, stamens 10, in two series, no petals ; fruit $\frac{1}{6}$ in., two wings, compressed, crowned with the remains of the calyx as a beak.
Cinnamomum Tamala,	see Trees, Opposite, Exstipulate, Simple.
Machilus odoratissima, *Kaula, mithpatta.* LAURINEÆ. F. B. I. v. 139, 859. Himalaya, 5,000 feet. Sutlej Valley, Suni (Collett).	large ; leaves 4-6 by $1\frac{1}{2}$-2 in oblong with a tapering point, shining, dark green, dotted with small glands ; flowers $\frac{1}{4}$-$\frac{1}{3}$ in. diam., pale yellow, fragrant, quite smooth in branching racemes, sepals 6, reflexed in fruit, stamens 9 in 2 series, fruit an ovoid or oblong drupe, dark purple when ripe, sometimes with a bloom on the surface, $\frac{1}{2}$-$\frac{3}{4}$ in. seated on the persistent calyx.
Machilus Duthiei, *Chan.* LAURINEÆ. F. B. I. v. 861. Himalaya, 4-9,000 feet. Simla, the Glen (Collett).	is very like the last, but the leaves are not so dark, the flowers are covered with silky down, and the fruit is round.
Phoebe lanceolata, *Badror.* LAURINEÆ. F. B. I. v. 141. Himalaya, 2-6,000 feet. Bhajji, Sutlej Valley (Collett).	small ; bark yellowish white ; leaves 5-8 by 1-2 in. crowded at the end of branches, narrow with tapering point smooth ; flowers in branching racemes not at the end of branches, $\frac{1}{10}$-$\frac{1}{8}$ in. pale yellow or white, sepals 6, hairy within, stamens 9 in 2 series, of 6 and 3 with 3 staminodes ; fruit $\frac{1}{2}$ in. narrowly

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

oblong with round ends, black when ripe, half buried in the calyx segments, which become stiff and pressed against it.

Litsæa sebifora,
Maidi-lakri, gwa.
LAURINEÆ.
F. B. I. v. 157.
The Plains.

medium size; bark dark grey, soft, corky; young parts covered with grey wool; leaves 4-10 in. long, ovate or oblong, short or long pointed, slightly downy above, and grey woolly beneath; flowers white in few 4-6 flowered clusters on a common short stalk with 4 bracts, male and female on different trees, calyx 4-6 lobed, tubular, stamens 9 or more; fruit round, $\frac{3}{10}$ in. diam., supported on the remains of the flower, black.

Litsæa polyantha,
Katmarra.
LAURINEÆ.
F. B. I. v. 162.
Salt range. The Plains to 3,000 feet.

small; bark dark grey, smooth; leaves 4-8 in. long, smooth above, rusty woolly beneath, broad: flowers as in last species but with five bracts; fruit ovoid oblong, $\frac{1}{4}$-$\frac{1}{3}$ in.

Litsæa languinosa,
LAURINEÆ.
F. B. I. v. 178.
Himalaya, 3,000 ft. Sutlej Valley (Collett).

small; bark brown; leaves 6-12 in. long, crowded at the end of branches, thick leathery, densely silky when young, narrow long pointed; flowers in fours in sessile clusters 1 in diam. silky or woolly, stamens 6, glands of inner stamens long stalked; fruit $\frac{1}{2}$ in. long, pointed at both ends, seated on the thick end of the stalk.

Litsæa umbrosa,
LAURINEÆ.
F. B. I. v. 179.
Himalaya, 3-9,000 ft. Mahasu, Narkanda (Collett).

small; bark dark brown; leaves 3-6 in. long, oblong long pointed, thinly leathery; flowers yellowish white with 5 bracts in small sessile clusters, calyx 4-lobed, stamens 6, with sessile glands not as long as in the last species; fruit $\frac{4}{10}$ in. diam., round or oblong on slender stalks $\frac{1}{2}$ in. long.

Elæagnus hortensis
ELÆAGNACEÆ.
F. B. I. v. 201.
Western Himalaya, 6-7,000 ft. (Edgeworth).

small; branches silvery with scales, often spinous, dark brown when older; leaves oblong ovate, 1-3 in. long, blunt, stalk $\frac{1}{4}$ in. silvery beneath; flowers $\frac{1}{6}$-$\frac{1}{4}$ in. long, silvery, bell shaped above, stalked, yellow, fragrant, solitary or in clusters of three, calyx of 4, triangular ovate, teeth, soon falling off, stamens

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

4, on the mouth of the calyx alternating with the lobes ; fruit $\frac{3}{4}$ in. long, oblong, red, dry or fleshy stone thick bony.

Putranjiva Roxburghii,
Jiaputa.
EUPHORBIACEÆ.
F. B. I. v. 336.
The Plains to 2,500 ft. Valleys of the outer hills (Collett).

medium size ; bark dark grey, nearly smooth with horizontal lines of white dots ; branches pendent ; leaves 2-3 in. long, evergreen, dark green shining margin wavy, ovate ; flowers, male nearly sessile in clusters, (female stalked, in pairs or solitary,) yellow, small, calyx 3-5 lobed, stamens 3, female flowers calyx 5-6 lobed, styles 3 ; fruit $\frac{1}{2}$ in. long, ovoid, stone very hard, pointed, wrinkled.

Mallotus philippinensis,
Rora, Raini, Roli.
EUPHORBIACEÆ.
F. B. I. v. 442.
Base of the Himalaya, Sutlej and Giri Valleys (Collett).

medium size ; bark thin dark grey, young branches rusty ; leaves 3-5 in. long, velvety beneath with crimson glands, stalk 2-3 in. long ; flowers in brown red spikes, minute, calyx 3 lobed, stamens 20-30 on a central receptacle, no petals ; capsules $\frac{1}{3}$-$\frac{1}{2}$ in. diam., 3 lobed, covered with crimson powder ; seeds round, $\frac{1}{10}$ in. diam., smooth, black. The crimson powder is called Kamela and used as an orange dye and as a vermifuge.

Sapium insigne,
Dudla, Lendua.
EUPHORBIACEÆ.
F. B. I. v. 471.
Himalaya, 5,000 ft. Valleys below Simla (Collett).

small ; bark grey corky, thick milky juice, branches thick, soft, branchlets leafy at the tips, leaves 6-12 in. long, oblong, long pointed, soft, smooth ; flowers yellow green in long fleshy terminal spikes, male flowers in circular clusters, calyx 2 lipped, deeply cleft, stamens 2, short, top scarlet, female flowers nearly sessile, solitary, calyx 2-3 cleft, ovate, long pointed, styles 3, short recurved ; capsule ovoid $\frac{1}{3}$ in long, obscurely lobed on a fleshy spike.

Myrica Nagi,
Kaiphal.
F. B. I. v. 597.
Himalaya, East of the Ravi river, 3-6,000 ft. Simla, the Glen (Collett).

small, bark brownish grey rough vertically wrinkled, branchlets velvety ; leaves 3-7 in. by 1-2 in., leathery, with aromatic dots beneath ; flowers in bracteate cylindric catkin like spikes, male flowers with 3-6 stamens in axils of broad bracts, female with 2 styles in glandular bracts ; fruit $\frac{3}{4}$ in. long, ovoid, succulent, edible, pulp of red spindle shaped fibres, radiating from the wrinkled nut. The bark is used as a stimulant carminative and astringent.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

CONE BEARING.

Leaves narrow Linear.

Taxus baccata, **Yew,** *Barma, thunu.* CONIFERÆ. F. B. I. v. 648. Himalaya 6-11,000 ft. Mahasu, Narkanda (Collett).	medium size; bark reddish grey, thin, smooth flaking in longitudinal shreds; leaves in 2 rows, dark green, light or rusty beneath, leathery, 1-1$\frac{1}{2}$ by $\frac{1}{10}$ in., narrowed into a short stalk; cones sessile axillary, male and female on different trees, male $\frac{1}{4}$ in., bracts empty, stamens in a cluster at the top, female minute, bud like, two upper bracts enclose the seed with the disk; fruit, an ovoid berry $\frac{1}{2}$ in. long, consisting of a red fleshy cup nearly concealing the flattened olive-green wingless seed.

Leaves needle-like.

Pinus excelsa, **The Blue Pine,** *Kail, biar, darchir.* CONIFERÆ. F. B. I. v. 651. Himalaya, 6-12,000 ft. Simla (Collett).	large; bark smooth slatey and leathery on young trees, grey and corky with shallow furrows on older trees; leaves in clusters of 5, 6-8 in. long, three cornered, bluish-green, in sheaths pinkish brown, soon falling off; male cones or catkins $\frac{1}{3}$ in. long in crowded clusters, with many scales, each scale carries two anthers, female cones, two or three together, 6-12 in. long, first erect, then pendulous on stalks 2-3 in. long; seeds $\frac{1}{3}$-$\frac{1}{2}$ in., black with a long, thin wing.
Pinus longifolia, *Chir, chil.* CONIFERÆ. F. B. I. v. 651. Himalaya, 1,500-6,000 ft. Simla (Collett).	large; bark, outer corky and in thin crisp pieces, reddish brown, inner bark brick red; leaves in clusters of 3, 9-12 in. long, light green, sheaths grey, persistent fringed 3, male catkins $\frac{1}{2}$ in. long, female cones ovoid with scales thickened at the apex, 4-8 by 3-5 in. at the lower end, seeds with a short wing. Gandabaroza, turpentine and tar are obtained from this tree.
Pinus Gerardiana, *Miri, galgoja.* CONIFERÆ. F. B. I. v. 652. Dry inner Valleys of the Himalaya, 6-12,000 ft. Kurram Valley 7-11,000 ft.	medium size; bark smooth, often silvery, flaking in long pieces; leaves in clusters of 3, 3-5 in. long, stout, stiff, dark green, persistent for 3-4 years' sheaths soon falling off; male catkins $\frac{1}{3}$-$\frac{1}{2}$ in. long, female cones ovoid, 6-9 by 4-5 in., bluish green, young erect scales with a recurved spine from the upper margin; seeds 1 in. long, cylindric, wing short soon falling off, eaten when roasted, called Chilgoza or Neoza.

TREES WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

CONE BEARING.

Leaves needle-like.

Cedrus Libani, var Deodara, *Kelo, Diar.* CONIFERÆ. F. B. I. v. 653. Himalaya, 4-12,000 ft.	large ; bark greyish or reddish-brown, thick, furrowed vertically and cracked transversely ; branches and branchlets horizontal, tips nodding ; leaves in dense clusters, short, 1-1½ in. long slender, bluish green, sheaths very short ; male catkin single, erect, 1 in. long, female, cones erect, 4-5 in. long ovoid, scales soon falling off leaving a central spike ; seeds ¼ in. long triangular, wing triangular, ⅔ in. long.
Picea Morinda, Himalayan Spruce, *Rau, Tos.* CONIFERÆ. F. B. I. v. 653. Himalaya, 6-11,000 ft.	large ; bark rough greyish-white, peeling in round flakes about an inch. in diameter ; branches horizontal, branchlets slender hanging down like tassels ; leaves scattered, short 1-1½ in. long, four-sided, needle like, dark green, stiff ; male catkins usually single cylindric, sessile 1 in. long, cones terminal, hanging down, blunt, 4-6 in. long, dark brown when ripe, scales with a thin edge ; seeds ⅔ in. long with the abruptly ended wing.
Abies Webbiana, var. Pindrow, Himalayan Silver Fir, *Tos, Rai.* CONIFERÆ. F. B. I. v. 654. Himalaya, 7-12,000 ft.	large ; bark dark brown or grey, fissured into long narrow scales ; branches horizontal, flat, branchlets the same ; leaves 2-3 in. long, narrow linear, very dark green, foliage appears black at a distance ; male catkins ¾ in., sessile clustered, stamens with 2 pockets, cones always erect, 2-4 in. long, cylindrical, purple, scales closely overlapping ; seeds oblong with a wing, abruptly ended ½-1 in. long.

TREES WITH ALTERNATE EXSTIPULATE LOBED LEAVES.

PETALS UNUNITED.

Marlea begoniæfolia, *Budunar, sialu, padlu.* CORNACEÆ. F. B. I. ii. 743. Himalaya 1-6,000 ft. Simla (Collett).	medium size ; bark smooth grey, young parts velvety ; leaves 3-10 in. long from round to broad-oblong, unequally sided, usually lobed like a maple ; flowers white, ¾ in. long in axillary bunches, calyx minutely 6-toothed, petals ⅔ in. long, 6-8, strap shaped, stamens 6-8 ; drupe, ovoid, dark purple, ⅓ in., crowned with the calyx, stone in pulp, two celled.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

COMPOUND LEAVES.

PETALS UNUNITED.

Cratæva religiosa, *Barna.* CAPPARIDACEÆ. F. B. I. i. 172. The Plains.	medium size ; bark grey, fairly smooth with long horizontal wrinkles ; leaves of three leaflets, stalk 4-6 in. long, leaflets 3-6 by 1½-3 in., ovate ; flowers in level many-flowered bunches, 2-3 in. diam., pale greenish yellow to purplish, sepals 4, soon falling off, petals 4, long stalked, stamens many on a short column surrounding a long thread with ovary above ; fruit a many seeded, ovoid berry, 1-2 in. diam., rind rough with white dots, seeds ¼ in. long, nearly smooth, kidney shaped, black in pulp. The bark is an antipyretic and sedative ; the fresh leaves are rubefacient and vesicant.
Averrhoa Carambola, *Khamrak.* GERANIACEÆ. F. B. I. i. 439. The Plains.	small ; leaves pinnate with a terminal leaflet, leaf stalk stout, velvety, leaflets 2-5 pairs, ovate, 1½-3 in. long smooth, long pointed ; flowers small, variegated white and purple, sepals and petals 5 of each, stamens 10 ; fruit, yellow, fleshy, 3 in. long, oblong, acutely 5-4 ridged, edible, seeds 2-5 in each cell, each seed surrounded by a fleshy appendage (aril).
Averrhoa Bilimbi, *Bilimbi.* GERANIACEÆ. F. B. I i 439. The Plains.	small ; same as the last, but leaflets 5-12 pairs oblong, velvety beneath, fruit with rounded lobes and seeds without the fleshy appendage.
Murraya exotica.	see Shrubs, Alternate, Exstipulate, Compound.
Murraya Kaenigii, *Gandalu, gandanim.* RUTACEÆ. F. B. I. i. 503. The Plains to 5,000 ft.	small ; a strong scented tree with brown bark, usually velvety or woolly ; leaves 6-12 in. long, leaflets, 9-25, 1-1½ in. long, alternate ; flowers white, ½ in. long in terminal flat topped branching racemes, sepals 5, stamens 10, petals 5, dotted ; fruit ovoid ⅓ in. diam., black wrinkled, seeds embedded in a gummy substance.
Limonia acidissima.	see Shrubs, Alternate, Exstipulate, Compound.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Feronia Elephantum, Elephant or Wood apple,
Bilin, Kait-bel
RUTACEÆ.
F. B. I. i. 516.
The Plains to 1,500 ft.

medium size ; spinous ; bark blackish-grey wrinkled and with shallow longitudinal furrows ; leaves smelling of aniseed with an odd number of leaflets, leaflets 5-7, opposite toothed, gland dotted ; flowers ½ in. diam., reddish green in loose clusters, calyx 5 toothed, soon falling off, petals 4-5, stamens 10-12 ; fruit with woody rind, round, grey, rough, 2½ in. diam., edible, seeds oblong, buried in pulp.

Ægle Marmelos,
Bel.
RUTACEÆ.
F. B. I. i. 516.
The Plains to 4,000 ft.

medium size, spinous, bark grey corky ; leaves 3½-6½ in. long, leaflets 3-5, lateral sessile, terminal one stalked, 2-4 by 1-1½ in. ; flowers greenish-white in bunches 1 in. diam., sweet scented, calyx 4-5 toothed, flat, velvety, petals 4-5, spreading, stamens many ; fruit 2-7 in. diam., round with grey woody rind, pulp orange coloured, sweet, seeds many in gummy pulp. The pulp of the fruit cures dysentery.

Ailanthus excelsa,
Arua, Maharukha.
SIMARUBACEÆ.
F. B. I. i. 518.
The Plains, Delhi Dist.

large ; leaves one foot or more long, with an unequal number of leaflets ; leaflets numerous, on long stalks unequal at the base, hairy ; flowers small, yellowish in long bunches calyx small, 5 cleft. petals 5 spreading, edges inverted, stamens 10 in male flowers, stamens 2-3 in two sexed flowers, none in female flowers, styles 2-5, united ; fruit of 1-5 long membranous red twisted, wings 2 by ½ in. long, each with one seed.

Boswellia serrata,
Salar, salhi.
BURSERACEÆ.
F. B. I. i. 528.
Base of the Himalaya, East of the Sutlej river.

medium size, spreading flat crown, bark reddish-yellow or greenish-grey peeling off in thin flakes ; a clear gum exudes which burns with a pleasant odour ; leaves crowded at the ends of branches; with unequal leaflets, leaflets 8-15 pairs besides the end one, 2-3 in. long, short toothed, tip usually rounded ; flowers small, white in racemes, calyx small, 5-7 cleft, petals 5-7, stamens 10-12 ; drupe ½ in. long, three angled splitting into three portions, one bony seed in each surrounded by the woody disk.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Melia Azadirachta, or Azadirachta indica, *Nim.* MELIACEÆ. F. B. I. i. 544. The Plains to 5,000 ft.	large, evergreen ; leaves pinnate, 8-1 in. long, crowded at the ends of branches, leaflets 9-15, smooth lanceolate, toothed, 1-3 by $\frac{1}{2}$-1$\frac{1}{2}$ in. ; flowers $\frac{1}{6}$-$\frac{1}{5}$ in. long, white, sweet scented, in long stalked branching racemes, shorter than the leaves, calyx 4-5 cleft, small, petals 5, stamens 10 united into a tube ; fruit oblong $\frac{1}{2}$-$\frac{3}{4}$ in. long, smooth-greenish yellow, one seeded. The bark is a febrifuge, and the oil from the seeds is an insecticide.
Melia Azedarach, Persian Lilac, *Bakain.* MELIACEÆ. F. B. I. 534. The Plains to 5,000 ft.	medium size, bark smooth dark grey ; leaves bipinnate or tripinnate, 9-18 in. long, pinnæ usually opposite, leaflets 3-7 on each pinnæ, ovate, long pointed ; flowers lilac, $\frac{1}{4}$-$\frac{1}{3}$ in. long, sweet scented in branching racemes, calyx segments 5-6, short, petals 5-6, linear, stamens 10-12 united into a purple tube ; fruit round, $\frac{1}{2}$ in. diam., yellow wrinkled, five seeded.
Walsura ternata, MELIACEÆ. F. B. I. i. 563. The Plains at Sheikhpura.	small ; leaves 8 in. long ; leaflets 3, 4-5 by 1 in., smooth, shining, white beneath ; flowers $\frac{1}{8}$ in. long, milk white in branching racemes, shorter than the leaves, calyx short 5 fid, petals 5, oblong spreading, stamens 10 united below ; berry narrow, oblong, one celled and one seeded, seed enclosed in a fleshy appendage.
Cedrela Toona, *Tun.* MELIACEÆ. F. B I. i. 568. The Plains to 3,000 ft.	large ; bark smooth, dark grey, thin : leaves with equal number of leaflets, 1-2 ft. long ; leaflets 8-30, with smooth margins, 2-6 by $\frac{3}{4}$-2$\frac{1}{2}$ ins., long pointed ; flowers in branching drooping racemes nearly as long as the leaves, cream coloured, sweet scented, sepals 5, blunt, hairy, petals 5 fringed with marginal hairs, stamens 5 on fleshy hairy orange lobes ; capsule $\frac{3}{4}$-1 in. long, oblong, dark brown ; seeds with a membranous wing at each end. This tree yields good red wood for furniture.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Cedrela serrata,
Hill Toon,
Darli, chutisirin.
MELIACEÆ.

Himalaya, 3-8,000 ft.
Matiana, Sainj (Collett).

medium size ; bark with regular longitudinal cracks ; leaves with usually an unequal number of leaflets, 2-3 ft. long, leaflets 24-48, 3-8 by 1-2½ in., ovate, long pointed, margin toothed ; flowers in loose drooping branching racemes, longer than the leaves, pink, sepals 5 or 6, often smooth, petals 5 or 6, smooth, stamens 5 alternating with 5 staminodes ; capsules 1 in. long, ovoid, pointed, dark grey ; seeds winged only at the upper end.

Sarindus Mukorossi,
Soap-nut tree,
Ritha, dodan.
F. B. I. i 683.
The Plains to 5,000 ft.

small, bark grey ; leaves even pinnate, 12-20 in. long, crowded at the ends of branches ; leaflets 10-20, 3½-6 by 1-2 in., smaller at the end of the leaf ; flowers white or purple in branching racemes, $\frac{1}{10}$ in. long, petals 4 as a rule fringed with hairs and 2 woolly scales on each side of its stalk, stamens 8, far protruding ; fruit fleshy round $\frac{3}{4}$-1 in. long, one seeded, covering saponaceous, wrinkled when dry, yellow ; seed black, loose in the fruit when dry, the fruit is commonly used instead of soap for washing clothes.

Rhus semi-alata,
Tekri, Titri, dudla kakkari.
ANACARDIACEÆ.
F. B. I. ii. 10.
Himalaya, 3-7,000 feet.
Simla, the Glen, Mahasu (Collett).

small, young parts grey velvety ; leaves, odd pinnate, 12-18 in. long, upper part of leaf stalk winged; leaflet 9-13, lateral sessile, end one on a long winged stalk ovate, 2-5 in., closely and sharply toothed, lower surface reddish white woolly ; flowers $\frac{1}{10}$ in. diam. pale yellow green, in large dense branched racemes, racemes, as long as the leaves, calyx small 4-6 cleft, petals 3-5 fringed with hairs stamens 3-5 or 6 or 10 ; fruit a drupe $\frac{1}{4}$ in. diam. woolly red-brown, acid, edible.

Rhus punjabensis,
Titri, choklu, dor.
ANACARDIACEÆ.
F. B. I. ii. 10.
Himalaya, 38,000 feet.
Simla, Jaku, The Glen (Collett).

small, bark rough, dark grey, leaves aromatic, young parts velvety ; leaves odd pinnate, 12-18 in. long, stalk not winged, leaflets 11-13, lateral sessile, end one stalked, ovate, 2½-5 in., margin smooth or toothed towards the tip ; flowers on broad branching racemes much shorter than the leaves, flowers yellow green, less than $\frac{1}{10}$ in. diam.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

calyx, petals and stamens as above, drupe red woolly $\frac{1}{4}$ in. diam.

Rhus Wallichii,
Ark[illegible]r, kambal rikhul.
ANACARDIACEÆ.
F. B. I. ii. 11.
Himalaya 6-7,000 ft.
Simla, the Glen (Collett).

small, something like the walnut (Juglaus regia), bark smooth grey from which a black acrid varnish exudes; all parts rusty woolly; leaves odd pinnate, 12-18 in. long; leaflets 7-11, lateral sessile, end one long .stalked, 3-9 in. abrutly pointed; flowers $\frac{1}{10}$ in. in short branching racemes, calyx as above petals 4-6, yellow green with dark veins, stamens. as the last, fruit ovoid, $\frac{1}{3}$ in. long, brown woolly at first; then smooth.

Rhus succedanea,
Arkhol, hulashing, lakhar
ANACARDIACEÆ.
F. B. I. ii. 12
Himalaya, 3-6,000 ft.
Valleys near Simla
(Collett).

small, everywhere smooth; leaves crowded at the ends of branches 6-18 in. long, odd pinnate, leaflets 7-13, lateral shortly stalked. end one long stalked, ovate, long pointed, smooth, shining; flowers in drooping branching racemes shorter than the leaves, green, yellow, $\frac{1}{12}$ in. diam., calyx 5 fid, much shorter than the petals, petals 5, stamens 5, drupe $\frac{1}{4}$ in. diam., round. smooth, yellow.

Odina Wodier,
Jhingan, k[illegible]lu, sulambra
ANACARDIACEÆ.
F. B. I. ii. 29
The Plains to 5,000 ft.
Valleys below Simla
(Collett).

medium size, trunk thick, branches few, branchlets thick, soft, bark grey smooth at first, in age peeling in round flakes, red inside; leaves few at the end of branches, odd pinnate. 12-18 in. long, leaflets 6-8, 3-6 in. long, oblong, ovate, long pointed; flowers in dense branching racemes at the ends of the branches while leafless, male and female on different branches or trees, $\frac{1}{10}$ in. diam., greenish-yellow, calyx 4 cleft, petals 4, in males, stamens 8, in females styles 4, short, thick; drupe oblong, kidney shaped, $\frac{1}{4}$ in. long, red when ripe, stone hard.

Moringa pterygosperma, Horse radish tree,
Sainjna.
MORINGEÆ.
F. B. I. ii. 45.
The Plains to 3,000 ft.

medium size; bark corky, wood soft, fruit is hot like horsh radish; leaves 12-24 in. long, usually 3 pinnate, stalk sheathing; pinnæ 8-12; leaflets 12-18, $\frac{1}{2}$-$\frac{3}{4}$ in. long, unevenly ovate or with broad tip. linear glands at the base; flowers white, scented, 1 in. diam. in axillary spreading branched racemes with linear bracts, sepals 5, linear lanceolate, reflexed, petals

5, narrow at the base, broad atthe tip, stamens 5 with anthers, 5 without, capsule 19-18 by $\frac{1}{3}$ in. cylindrical hanging down, 9-ribbed, beaked, seeds many in pits, 3-angled, winged at the angles. The young root is like horse radish, oil from the seeds is an excellent lubricant, Ben Oil.

Spondias Mangifera,
The Hog-plum tree,
Ambara, bahamb.
ANACARDIACEÆ.
F. B. I. ii. 42.
The Plains to 5,000 ft.

small, bark smooth grey, aromatic ; leaves odd pinnate, 12-18 in. long, leaflets 9-11, opposite, 3-9 by $1\frac{1}{4}$-4 in., smooth ; flowers in terminal branching spreading racemes, greenish white, $\frac{1}{4}$ in. diam., calyx 5 cleft, petals 5, stamens, 8-10, drupe $1\frac{1}{2}$-2 in. long, yellow smooth, flesh acid, astringent, edible, stone fibrous pitted within, seeds 1-3, usually one perfect. The ripe fruit is a useful antiscorbutic.

Juglans regia,
Walnut.
Akhrot, charmaghz, starga.
JUGLANDEÆ.
F. B. I. v. 595.
Himalaya, 3-10,000 ft.

large, aromatic, shoots velvety ; bark grey, fissured vertically ; leaves odd pinnate, 6-15 in. long, woolly when young ; leaflets 5-13, opposite, 3-8 by 2-4 in., lateral nearly sessile, end one shortly stalked ; flowers, male and female on the same tree on spikes green, males in pendulous catkins, calyx 5 lobed stamens 15-20, females 1-3 clustered, calyx 4 toothed, petals 4 linear lobed, styles 2, short recurved ; fruit 2 in. long, ovoid, green with yellow dots, skin leathery, very aromatic, nut 1-$1\frac{1}{2}$ in. long, ribbed, thick shell, two valved, seed corrugated 2 lobed. The wood is very good for making into furniture. From the seeds excellent oil for culinary and illuminating purposes is expressed, the bark is a vermifuge.

Phœnix sylvestris,
Date Palm,
Khajur.
PALMAE.
F. B. I. vi. 425.
The Plains to 3,000 ft.

large, trunk covered with the remains of old leaf stalks, unbranched ; leaves form a crown on the summit of old trees, pinnate, 4-8 ft. long, leaflets 9-18 in. long, $\frac{1}{2}$-$\frac{3}{4}$ in. broad, thick, folded at first, sessile ; flowers, male on a compact spike in a broad spathe, female on a spike 2-$2\frac{1}{2}$ ft. branching ; male and female with 3 sepals and petals ; fruit 1-$1\frac{1}{2}$ in. long, yellow reddish brown when ripe, sweet, stones 1 in. long, deeply grooved on one side.

TREES WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS NONE.

Schleichera trijuga, The Lactree,
Gosum, kussumb, samma.
SAPINDACEÆ.
F. B. I. i. 681.
The Plains East of the Sutlej river.

bark grey, peeling in irregular pieces, red inside leaves with an equal number of leaflets, 8-16 in. long, pink when young, dark green when old, leaflets 4-8, 2-9 by $1\frac{1}{2}$-$3\frac{1}{2}$ in., the terminal pair much the longest, oblong or ovate ; flowers yellowish green in drooping racemes at the ends of branches, calyx 4-6 cleft, small, stamens, 6-8, longer than calyx, hairy, petals none ; fruit dry, pointed, smooth or spinous, $\frac{3}{4}$-1 in. long, seeds 1 or 2 in a pulpy appendage, edible, pleasant acid flavour. Lac is produced on this tree by the Coccus lacca insect.

Pistacia integerrima, or Khinjuk,
Kakkar, sarawan, gurgu.
ANACARDIACEÆ.
F. B. I. ii. 13.
The Plains, Peshawar, Salt range, Himalaya, 1,500-8,000 feet. Simla (Collett).

bark rough, grey ; large crooked galls, kakrisingi, form on the leaves in autumn and are sold as medicine. leaves, odd or even pinnate, 6-9 in. long ; leaflets 8-12, 3-6 by 1-$1\frac{3}{4}$ in., very long pointed, smooth ; flowers small, male and female on separate trees, no petals, red in lateral branching racemes appearing with the young leaves which are also red, in male flowers calyx 5 cleft very small, stamens 5-7 ; female flower calyx 4 cleft, lobes soon falling off, styles 3, recurved ; drupe $\frac{1}{4}$ in. diam., broader than long, wrinkled, grey when ripe, seed with a membranous coat.

Engelhardtia Colebrookiana,
Timar rakh.
JUGLANDEÆ.
F. B. I. v. 596.
Himalaya, East of Chenab, to 6,000 ft.

small, bark grey, shoots woolly ; leaves odd pinnate, 8-12 in. long, leaflets 6-11, end one smallest, often wanting, lateral nearly opposite, shortly stalked, 3-5 in. long, woolly beneath; flowers in spikes, small green, males in slender catkins, calyx 4-5 fid, stamens 4-5, nearly sessile, females in pendulous spikes, 3 large unequal bracts, calyx 4 toothed, hairy, petals none. style of 2-4 branches ; fruit a small round nut, $\frac{1}{4}$-$\frac{1}{3}$ in. diam., hairy, seated on a 3 lobed bract.

(*To be continued.*)

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part IX with Plate IX and Diagram 1.

(*Continued from page 735 of Volume XVIII.*)

THE COMMON WOLF-SNAKE (*LYCODON AULICUS*).

Nomenclature (*a*) *Scientific.*—The generic name (Gr. λυκος wolf and οδους tooth) originated with Fèrrusac* in 1826, and has reference to the long teeth in the upper and lower jaws which, from their situation and superior length, resemble the canine teeth of wolves and dogs. It is these long teeth which mislead many who inspect the mouth carelessly, into supposing the snake a venomous one. As a matter of fact they are solid, nor canaliculate.

The specific title (Latin=a house dweller) was introduced by Carl Linné in 1754, and emphasises the fact that it is usually met with inside habitations.

(*b*) *English.*—The Common Wolf-Snake seems to me the best name for it.

(*c*) *Vernacular.*—Though so common I know very few names for it. It is frequently confused by natives with the krait, and known by the same name locally as its poisonous relative. Thus Mr. DeAbreu tells me it is called "krait" in Behar, Willey† says it shares with the Ceylon Krait (*B. ceylonicus*) the name "tel karawala" in Ceylon. Baboo Awmoola Ruttum Bysack gives "kaurialla" as one of the names for the common krait (*B. cæruleus*), but I think it is more correctly applied to the common wolf-snake. I have heard this name given several times, and it appears to refer to the marks on the back resembling the little cowry shell, "kaurialla" or "kauriwalla" implying a wearer of cowries. A European subordinate with some knowledge of snakes told me that the common name in the Kheri District (U. P.) for it is "garar". In S. India Father Bertrand tells me it is one of the snakes called "Soovar pambu" or "wall

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* Bull. de Science, Nat., p. 238.

† Spol. Zeylan, 1906, p. 229.

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snake". Colonel Dawson informs me that in Travancore, this and *L. travancoricus* with other species are called "shunguvarian," the Malayalam word for conch shell being "shungu" alludes to the marks on the back. I heard it called "choorta" in Cannanore, but again here the term was loosely applied.

Colour and Varieties.—I cannot do better than first quote from Boulenger (Cat., Snakes, 1893, Vol. 1, p. 353).

"*A.*—Labials without spots; a triangular whitish blotch on each side of the occiput, the two sometimes confluent and forming a collar; back with whitish cross bands bifurcating on the sides (*L. aulicus*, Linné).

B.—Labials without spots; a whitish collar and a few (2—5) whitish cross bands on the anterior part of the body.

C.—Labials without spots; no collar; no dorsal spots or bands.

D.—Some or all of the labials with a brown spot; a whitish collar or a triangular whitish blotch on each side of the occiput; back with whitish cross bands bifurcating on the sides, or with a dorsal series of quadrangular blotches, or with white lines disposed irregularly or forming a wide-meshed net work (*L. capucinus*, Boie).

E.—Each upper labial with a brown spot: no collar; no light spots or lines (*L. unicolor*, Boie)."

Boulenger's variety *D.* includes three varieties the β, γ, and δ of Günther*. I cannot see the justification for recognising any of the above varieties, which appear to me completely connected, unless var. *B.*, about which I am not certain, deserves special mention.

I find on referring to my note books that I have examined, and remarked upon 191 specimens from widely separated localities in India, Burma, and Ceylon. Between specimens that have yellow or yellowish cross bars in the whole body-length extending often on to the tail, and those with no marks at all I find every degree of variation. In some not even the occipital band is to be seen, in others it alone may be obscure or distinct, in others two, three, four, or many cross bands may be visible, the anterior always most so. Varieties *A.* to *E.* therefore appear to me completely connected. I find that the colour of the lips to which Boulenger attaches importance varies too. Often the upper is uniform yellow or yellowish, often

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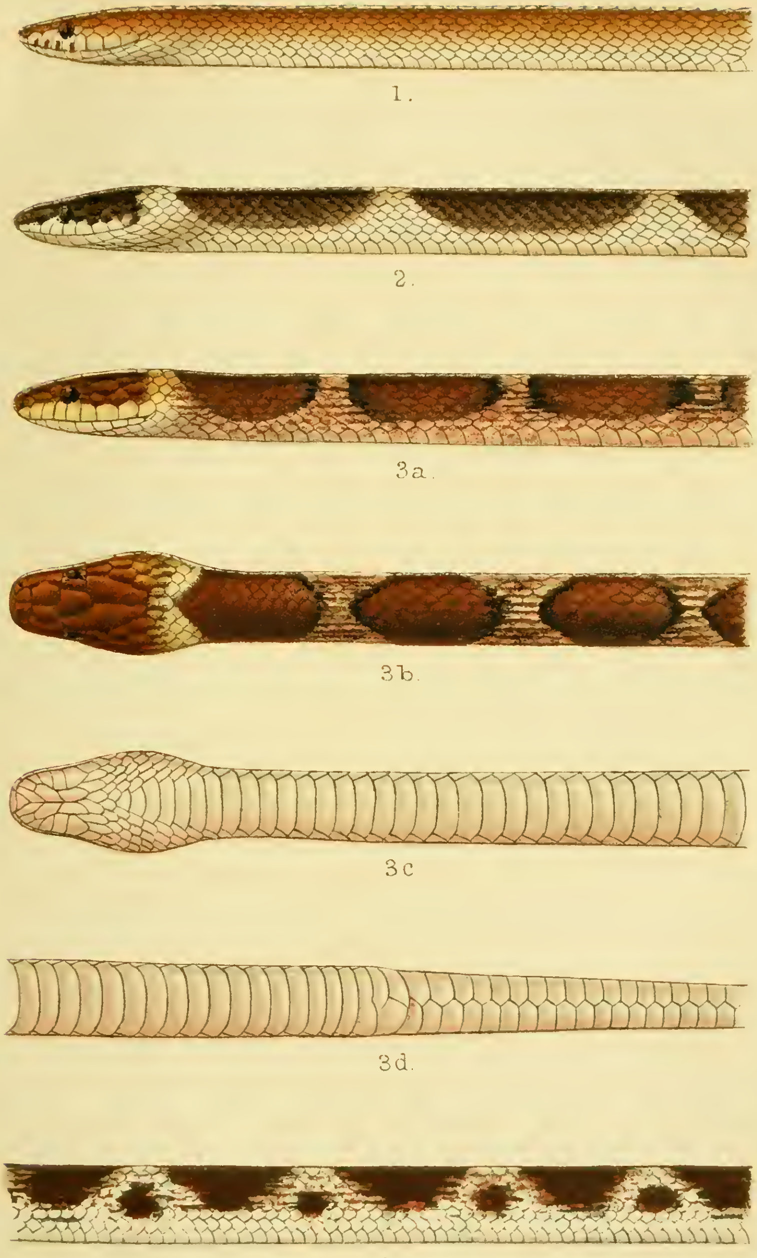
* Rept., Brit. Ind. 1864, p. 316



J G. del. J. Green, Chromo

THE COMMON INDIAN SNAKES, (Wall).

1, 2, 3. Lycodon aulicus, *harmless, nat size.*

4. Lycodon striatus, *harmless*, × 1.

again more or less mottled with brown especially anteriorly, or some of the labial shields bear a single median brown spot.

There appear to me to be but two varieties and these are so marked that I am inclined to think they must breed true "inter se."

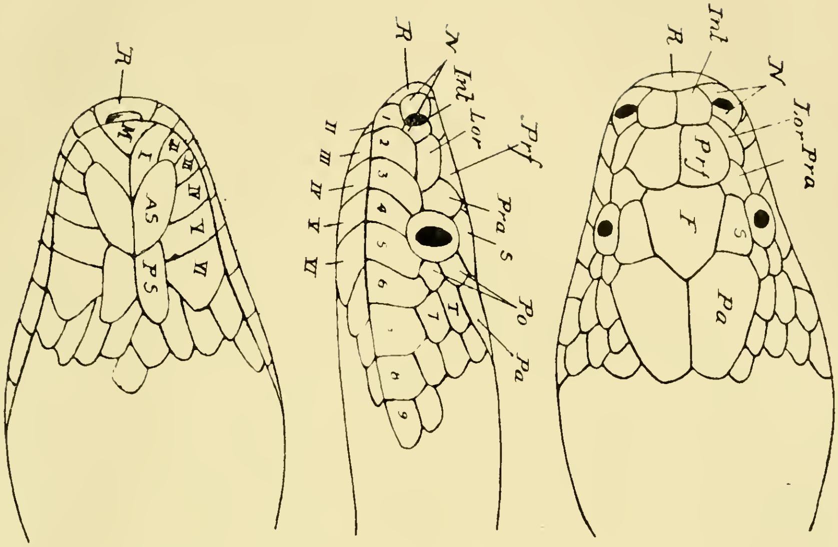
In variety *typica* the brown varies from the light hue seen in figure 1 to the dark-brown of figure 2. The bars are yellow or yellowish never quite white in life, though the yellow becomes white rapidly in spirit. They broaden laterally and dissolve into a network pattern in which the scales involved are outlined with yellow. This reticulation is not clearly shown in figure 3 of our plate. It so often happens that the cross bars fade away posteriorly, that in a large number of specimens one cannot count them in the whole body-length. I have therefore noted in a large series the bars that can be counted in the anterior *half* of the body (not including the tail), and find that they usually vary from 9 to 18. In some uncommon examples they may be very few, or even absent, the latter rarities conforming to the types of *unicolor* (Boie), and *hypsirhinoides* (Theobald). Further, the scales involved in the interval between the first and second bars (not the bar on the back of the head) vary from 5 to 10, and this is of importance in determining the uncommon specimens in which but two or three bars are visible. *Typica* is the common variety distributed throughout Indian and Burmese limits. In the second variety for which I propose the name *oligozonatus* the ground colour is always dark as in figure 2 of our plate or darker still approaching black. The bars are white, not yellowish. Laterally they dilate without dissolving into a net-work. They are distinct in the *whole* body-length numbering from 11 to 19. They are thus about half as numerous as in variety *typica*. The number of scales involved vertebrally in the interval between the 1st and 2nd bars varies from 12 to 19. The lips are white not yellow. Of this I got several specimens in Cannanore and have seen one from Bellary, but no others. It probably occurs only in S. India where it is far less common than *typica*.

In both varieties the underparts are pearly-white, with in *typica* sometimes a pinkish tinge.

Dimensions.—It grows to about two-and-half feet, but specimens over two feet are uncommon. I have records of only 19 over that length, and all my largest are females. My largest ♂ record is 2 feet 3⅛ inches, and I have had four ♀♀ larger, the maximum length being 2 feet 5 inches. Mr. Millard, however, gives me two records in excess of my figures. One is 2 feet 7½ inches, and another 2 feet 9 inches, the sex in both cases was not noted.

Bodily configuration, physiognomy, etc.—The Wolf-Snake is rather slender in form, the body cylindrical in outline or slightly flattened ventro-vertebrally and of much the same girth in the whole body length. The head is decidedly flattened, the snout broad, and rounded with an obtuse transverse ridge in front. The neck is sufficiently constricted to be distinctly evident. The nostril is moderate and occupies the full depth of the suture between the nasal shields. The eye is rather small and quite black so that no idea of the shape of the pupil can be discerned in life ; but shortly after death when the lens becomes opalescent from post mortem changes, or after immersion in spirit the pupil is seen to be vertical. The tongue is pinkish with white tips. The belly is obtusely keeled on each side, a feature favorable to clambering efforts. In this snake as in the dhaman, and many other species the "angulation" as it is usually called reminds one in section of a boat (see figure 1 B, Diagram 1, facing page 230 of Volume XVIII of this Journal). The tail is rather short being about one-sixth the total length of the snake. The whole snake is glossy owing to the smooth and polished surfaces of the scales ; a circumstance which has not escaped the Singhalese whose name for it "tel" karawala, implies "oily."

Identification.—The first thing to look at is the loreal which in this snake in common with a few others touches the internasal (see figures A and B of Diagram). This relationship of these two shields is only to be seen in 5 of the 11 known species of this Genus, in all the species of the Genera *Amblycephalus* and *Trachischium*, in *Xylophis perroteti* and in certain specimens of some *Hypsirhina*. In all the species of *Lycodon* that concern us the scales are in 17 rows in midbody, whereas this number of rows is not met with in any other species and genera just referred to. In *L. aulicus* and *striatus* the 1st and 2nd labials touch the nasal shields in the other three species the 1st only. It now remains to distinguish *aulicus* from *striatus*. In the former there are normally 9 supralabials, in the latter only 7 or 8. In the former the præocular frequently but by no means always touches the frontal, in the latter it never does so. In the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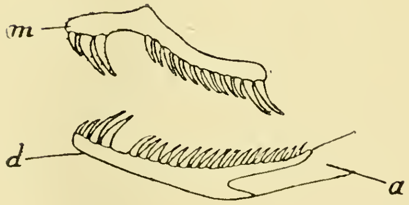
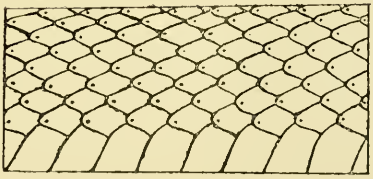
LYCODON AULICUS (+2).



E

(*m*) maxilla, (*d*) dentary and
(*a*) articular parts of mandible of
L. aulicus (enlarged).



To show scales with
apical pits.

COMMON INDIAN SNAKES (WALL).

former the belly shields (ventrals) are angulate, in the latter they are not. The former grows to 2½ feet, the latter to less than 1½. Whilst both are common in Peninsula India and Ceylon, the former extends East beyond the longitude of Calcutta, the latter does not. To sum up, the essential points in identification are (1) a loreal touching the internasal, (2) scale rows 17 in midbody, (3) nasal touching the 1st and 2nd labials and (4) 9 supralabials.

Haunts.—Of all the snakes that seem to seek out, and profit by a human environment the Common Wolf-Snake is the most conspicuous. I should think that fully half the snakes met with inside habitations throughout India would prove to be this species, and it certainly is far more frequently encountered inside bungalows, and outhouses than outside them. Not only is it a very frequent tenant of houses such as those occupied by the European population in Cantonments, but it frequently obtrudes itself into densely populated parts, such as bazaars, native towns, jails, etc., and is no rarity in the business quarters of our large Indian cities. I not infrequently have one brought in from the regimental lines, bazaars and jails, and have had it from inside regimental and Cantonment hospitals. Mr. Millard tells me he has "frequently had specimens sent to the Museum which have been killed in houses in the Fort at Bombay." Like many other snakes it likes to insinuate itself into the crevices of loose brickwork such as the foundations and walls of buildings. Here it conceals itself during the day emerging at nightfall in quest of food. Along the outer walls skirting the jail at Cannanore I rarely passed without finding the sloughs of this snake issuing from holes in the face of the masonry, and have often found it in similar situations elsewhere.

In houses it very frequently climbs into the roof, and I have several times known or had specimens sent me which had dropped on to the floors of rooms, verandahs, barracks, etc.

Disposition.—The Common Wolf-Snake is a very lively little customer, which usually on being discovered slips away hastily if circumstances permit. If pursued, or any attempt made to catch it, or obstruct its path it strikes out boldly without hesitation planting its teeth into whatever thwarts its progress, and I have been bitten many times in trying to effect its capture. If in the open, and baulked in its endeavours to escape it will frequently coil itself into a heap and remain stationary; and if worried will hide its head beneath its coils. Often too while lying thus it fixes its coils rigidly so that one can toss it into the air without it releasing its folds, as one might do a piece of knotted cane. A visit paid to such a specimen in its cage an hour or so later will probably show its courage restored, and it will inflict or endeavour to inflict a wound. Like most other snakes however it soon gets accustomed to being handled and will then suffer itself to be withdrawn from its cage without anger though it usually struggles to elude one's grasp. Mr. F. Gleadow tells me he "saw one in a climber in his verandah one night, and while examining him to see whether it was a *Lycodon* or a *Bungarus* with the aid of a hurricane lamp, he let out at me like lightning, and scratched my nose. It was a very smart stroke indeed. Nobody had touched him." Gunther* says of it: "It is of fierce habits and defends itself vigorously." Mr. Millard writes to me: "It is of a somewhat fierce disposition, and when first caught will usually turn and bite freely." Colonel Dawson too in a letter to me remarks on the fierceness of its nature.

Mice not infrequently fall victims to this snake, a fact which in itself speaks more eloquently than any remarks can do for the intrepid nature of such a diminutive reptile. Mice or at least individuals amongst them are most formidable antagonists for small creatures to encounter and I have collected several interesting records showing that a single one will not only defend itself against the snake or snakes into whose cage it has been put as food, but will sometimes actually turn the tables, fight, overpower, and devour the snake.

There is no doubt that this snake is responsible for a large number of cases of snake bite in India every year, a circumstance to which its commonness, courage, irascibility, nocturnal habits, and predilection for man's environment all contribute.

As the snake is nearly always pronounced a krait by Europeans and natives alike it is one of those snakes which has helped most to swell the list of reputed antidotes to snake poison, for anything given internally, or applied locally under the circumstances gets the credit of having averted the otherwise supposed inevitable fatality.

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* Rept. Brit. Ind., 1864, p. 316.

In a nervous subject, such as the native frequently is, a bite even from this harmless wolf-snake may prove fatal. Thus Dr. Willey* records a case in Ceylon of a woman who was bitten on the right forearm by a snake of this species one night, and who died in consequence, no doubt from fright.

In the *Indian Medical Gazette* of November 1st, 1870, Dr. Ewart reports the following case:—

" This morning. August 22nd, on visiting the General Hospital, I was informed that one of the punkah-coolies had been bitten, about 8-30 the night before, by a krait, whose venom is virulently poisonous. The man, it appears, had been sleeping, and on awaking he found something crawling over the right shoulder, and immediately experienced a stinging sensation about the middle of the acromion process. He was then under the impression that he had been bitten by a snake, and on procuring a light, a very lively snake was captured.

" The site of the bite was examined by Mr. Knight, the Assistant Apothecary, who declares he discovered a small puncture, on which there was a small quantity of coagulated blood. He is also positive that the tissues around, to the size of a two-anna piece, were puffed and swollen. Patient's pulse was irregular, and he was much alarmed and agitated ; the surface of the body was cold ; countenance anxious : pupils normal ; quite conscious and intelligent ; no dimness of vision, or vertigo.

" About four minutes after the man had been bitten, the part was freely scarified, and the cupping glass applied. Ammonia was given repeatedly at short intervals. Rum was also freely administered, and means were taken to prevent sleep.

" When the patient was presented to (us) as a specimen of snake-bite cured by cupping, ammonia, and rum, I expressed my doubts, after an examination of the seat of scarification, whether he had been bitten at all ; and if he had been bitten, whether the snake was poisonous.

" I submitted the snake to Dr. Fayrer, C.S.I., who pronounced it to be the ' *Lycodon aulicus* ' perfectly innocent. It is something like the Krait (*Bungarus cæruleus*), and often gets blamed accordingly. "

It is in such a case as this that the stimulating remedies which have enjoyed so great a reputation in the treatment of snake-bite are of real benefit, such for instance as brandy, ammonia, and strychnia. These agents have no influence in reducing or destroying the poisonous properties of snake venom, they are useless agents in the treatment of snake *poisoning*, but invaluable remedies in snake *bite*, a very different condition—where they act by counteracting the depressing influence which fright exerts upon the heart.

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* Spolia Zeylan. 1906, p. 228.

Habits.—The two most obvious traits in its character are its nocturnal habit, and its clambering propensities. It is seldom or never seen abroad in daylight unless disturbed. Mr. E. E. Green from his experiences writes to me : " It is quite nocturnal in its habits. In captivity it sleeps all day and refuses food." When not established in the safe quarters offered by masonry, or a hole in the ground, it coils itself during the day in any convenient dark shelter, beneath the boxes or stores, or among the packages on the shelf in one's storeroom, beneath the discarded bucket or basket behind the stable, beneath one of the flower pots standing in the verandah, in a heap of kunkur beside the road, or stack of bricks or wood, behind or beneath the piles of plant stored in the Supply and Transport godown or the Telegraph Office compound, anywhere in fact that offers a convenient refuge. In such situations, besides enjoying the semi-darkness so grateful to its tastes, it is brought into convenient association with the very creatures upon which it is wont to prey, the agile, but incautious mouse, the slippery skink, and the defenceless little gecko. At night the wolf-snake emerges from its fastness, and actively pursues its quest for food. The servants are apt to encounter it in the verandah when serving dinner, the inmates of a house in any of its rooms, the sepoy in his lines, the soldier in barracks, and the warder going his rounds in the Jail. Often too it will drop from the roof into the verandah amid the family circle, from the covered way to the kitchen, or from the disused punkah-pole, or cross-bar supporting curtains in the drawing-room.

Its climbing accomplishments are very remarkable, for it often puzzles one to know how it can have got on to some of the places from which one dislodges it. The top of a window ledge, the jilmils of a door, the top of the lintel of a door which has become loosened from the masonry, a punkah-pole, or curtain rod. I have frequently had opportunities of observing this snake climbing and find that it can do so with comparative ease even on a vertical plane, especially if the surface is a little rough. Thus I have many times witnessed it climb up the perpendicular wooden faces of its box, the boards being rough from the saw. It clambers with ease, throwing itself into an S shape, and appearing to balance itself on its tail. As one watches this performance one wonders at the support derived from the tail expecting every moment to see the snake fall, but no! the caudal extremity resting on the horizontal surface grows less and less, and finally follows the rest of the snake which adheres vertically wholly unsupported. Now some observers would have us believe that the force which operates in this acrobatic performance, is brought about by a muscular effort on the part of the snake which retracts its abdomen in such a way as to create a vacuum in its body-length opposed to the surface it is climbing. This, as in the case of an india-rubber cup which has been pressed to exhaust the air, adheres mechanically by the production of a vacuum. I happen on more than one occasion to have seen *Lycodon aulicus* moving up the glass face of its cage, it can do so in a wonderful manner till nearly all the body-length has left the floor, but though I have specially looked for it I have never been able to see the slightest indication of the muscular action referred to above, but have noticed that the whole surface of the abdomen lay pressed against the glass. I have never seen the snake succeed in scaling a face of glass except in the case of two hatchlings that I put into spirit. To my amazement I found one of these still wet from its immersion lying along the face of the jar above the level of the fluid, and here it maintained a firm attachment, so firm indeed that it almost supported the second one in its endeavours, to reach a similar position, and escape its fate. In this case also I specially noted that there was no attempt at any retraction of the abdomen. The jar in which this scene was exacted is some 5 inches in diameter, so that the curvature of the glass can have been little assistance to a creature little over 7 inches in length. The wolf-snake appears to me to climb by the aid of its ribs, and the free borders of its belly shields, and with these alone. Mr. Sinclair in this Journal (Vol. IV, p. 310) remarked upon one he saw scaling a chick stretched vertically and lashed in position. He says; "The snake evidently climbed by hitching the edges of the ventral shields on to those of the bamboo lattice of the blind, and not by winding his body which was entirely on the side of the blind next to me, round the bamboos." As already stated it will frequently climb up into the roofs of houses, but perhaps the most remarkable example of its scansorial achievements is that mentioned by Haly*, a specimen having been caught in the lantern of the Minicoy lighthouse in Ceylon.

Food.—*L. aulicus* whilst showing a preference for lizards of the gecko family accepts with avidity other small creatures that cross its path. I have on 13 occasions known it take geckoes always of the genus *Hemidactylus*, usually *frenatus* but also *coctaei.* On 8 occasions a mouse had furnished the meal, and on 6 other occasions skinks had been devoured. In the United Provinces *Mabuia dissimilis* ?, in Burma *Lygosoma cyanellum*, and once another *Lygosoma* too digested to determine. Mr. E. E. Green tells me in Ceylon he has known it take a *Lygosoma* in captivity. Willey says its staple food in Ceylon consists of the brahminy lizard, *Mabuia carinata.*

Foes.—I have known it fall a victim to the common krait, and the habits of the two snakes are so alike that I suspect the wolf-snake very frequently meets an untimely death at the jaws of its ophiophagous relative.

Breeding. The Sexes.—As already remarked the ♀ appears to grow to a greater length than the ♂. The sexes, as regards numbers appear to be equally balanced, thus my note books show that of 73 specimens sexed, 36 were males, 37 females.

I have known the sexes in company in November in Cannanore by report. In this case the native who brought the ♂ assured me it was united with another which escaped. In January in Fyzabad two were found in company in a bottlekhana, and in Dibrugarh two pairs were killed in company one in June and one in July. The June ♀ was heavily egg-bound at the time, but only the anterior half of the July specimen which I assume to have been a ♀ was brought in, the ♂ being perfect. It is evident that they do not dissolve partnership after sexual congress for a long time, if they do so at all, but this is a point upon which I am very uncertain and a very difficult one to elucidate. The smallest gravid females I have known were both 1 foot 6¼ inches long, a length probably attained at the beginning of the third year of life.

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* First Report Snakes, Colombo Mus. 1886, p. 15.

Anal glands.—I have found these glands which are supposed to be connected with the sexual functions active in both sexes, and at most parts of the year. The secretion is custard-like in colour and consistency. The copulatory male organs are beset with many minute recurved spines.

In a previous paper dealing with Russell's Viper (Vol. XVIII, p. 13) I remarked that I was inclined to think that the oldest mothers were the most fecund. My notes on the wolf-snake certainly make it appear so, for the smallest females, 1 foot 6¼ inches in length, contained 3 and 4 eggs, and the largest 2 feet 5 inches in length, 11 eggs. Further 5 of the 6 egg-bound specimens over 2 feet in length contained from 7 to 11 eggs, whilst in 8 others where the length is recorded, all less than 2 feet, only from 3 to 6 eggs were found "in abdomina." My figures are as follows :—

Length of ♀.	No. of Eggs.	Length of ♀.	No. of Eggs.
1′-6¼″	3	1′-10¾″	4
1′-6¼″	4	2′-0″	8
1′-8½″	3	2′-0⅝″	7
1′-8½″	4	2′-2⅛″	9
1′-8½″	5	2′-2¼″	5
1′-9″	5	2′-4″	7
1′-10¼″	6	2′-5″	11

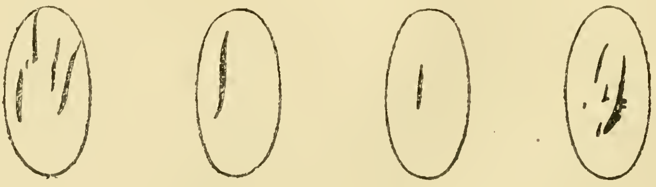
Eggs.—I have had many females brought to me gravid all with one exception during the first 7 months of the year. The one exception was egg-bound in Rangoon on the 20th December. Of the rest, one in Cannanore was gravid on the 20th January ; three in Cannanore in February ; one in Cannanore, and two in Fyzabad in March ; one in Cannanore, two in Fyzabad and five in Dibrugarh in April ; one in Cannanore and three in Dibrugarh in May ; one in Cannanore, and one in Fyzabad in June, and three in Fyzabad in July.

The eggs are deposited in the months from February to July. They vary in number from three to eleven but are usually from four to seven. They are elongate white ovals, equally domed at each pole, and soft to the touch, the shell resembling white kid, until vacated when it dries and hardens into a somewhat crisp parchment-like envelope. When seen "in abdomina" they are frequently but by no means always particoloured—grey and white. The grey colour appears to me to be due to absorption of colouring matter from the intestine, for it is always seen on that part of the shell which lies in contact with the gut, is absent when the gut is empty, and present in some eggs in the string corresponding to a loaded part of the intestine. It may be originally derived from the pigment in the skins of the creatures ingested. When laid the grey colour is never visible as far as I am aware.

When deposited the eggs measure from rather less than one to one-and-a-quarter inches and are rather more than twice as long as their breadth. They contain no trace of an embryo. The periods of gestation and incubation are not known to me.

Hatchlings.—These escape from the egg doubtless by means of the fœtal tooth, though I have failed to find it in the many examples I have examined. The appearance of the eggs after evacuation is similar to that seen in other species. A clutch of five was brought to me on the 18th July last year found in a Planter's bungalow. A single hatchling was present with the eggs, all of which, except a non-fertile one, were empty. I give a drawing of these eggs to show the cuts in the shells through which the young had gained their liberty. Each cut was as clean as if done with a sharp knife.

The young when they escape from the egg vary in length from 6¾ to 7¾ inches, or about one-third the length of a large adult. They are exactly like most adults in colour and markings. I have seen two of the same brood, one with very distinct yellow bars in the whole body-length, whilst the other had a few rather obscure bars anteriorly only. One of these was very vicious, and bit me more than once when handling it. It attacked, killed, and soon swallowed a young gecko I gave it.



EGGS OF *LYCODON AULICUS.*

To show incised apertures of exit made by hatchlings.

(nat. size).

Growth.—It is very difficult to follow the growth after the 2nd year from the figures to hand in my note books. It is certain however that when one year old the young have at least doubled their length being over 1 foot 1½ inches long but they hatch over such a long period of the year that the lengths become hopelessly mixed, leaving no gaps to indicate successive broods. An unusual number of specimens between 1 foot 6 inches and 1 foot 8 inches in length at the same period of the year, seems to indicate that this length is reached at the end of the 2nd and beginning of the 3rd year. Again a large number measuring from 1 foot 9 inches to 2 feet, seems to point to the termination of the third year's growth.

Distribution. (*a*) *Geographical*—Its range of habitat is very extensive. It occurs throughout Peninsular India to Ceylon and the Maldives. Westward it extends throughout the Punjab to the lower slopes of the Himalayas. I can find no record of it from Sind however. To the East it ranges through the Bramaputra, and Irrawaddy-Salween Basins (including the Andaman and Nicobar Islands), to the Eastern limits of Indo-China in the continental part of the Malayan sub-region, and through the Malayan Archipelago to the Philippines.

(*b*) *Local*—It is essentially an inhabitant of the Plains. I have known it fairly common on the lower slopes of both Western, and Eastern Himalayas up to about 2,000 feet, but it appears to rarely wander above this altitude. Ferguson* in this Journal says though common in the low country in Travancore he has not recorded a single specimen from the Hills. Flower† remarked on a specimen he obtained at Penang at an altitude of 2 200 feet. Willey‡ too says that though common in the low country in Ceylon it does not appear to ascend to 3.000 feet.

In the Plains it is common everywhere, and hardly a collection of snakes amounting to half a dozen specimens made anywhere will fail to show at least one representative. I cannot recall ever having seen or heard of a specimen in or close to water, or in damp places.

Lepidosis. *Rostral.*—Touches six shields, the rostro-nasal sutures largest. *Internasals.*—Two the suture between them one-half to three-quarters that between the præfrontal fellows, equal to or rather greater than the internaso-præfrontals. *Præfrontals.*—Two, the suture between decidedly greater than the præfronto-frontal sutures; in contact with internasal, loreal, præocular, (sometimes the supraocular) and frontal. *Frontal.*—Touches 8 shields usually, (sometimes 6 only, when the præocular fails to meet it) the sutures sometimes subequal or more often the supraoculars rather longest. *Supraoculars.*—About two-thirds the length, and half the breadth of the frontal. *Nasals.*—Two, subequal, in contact with the 1st and slightly with the 2nd supralabial. *Loreal.*—One, twice as long as high, longer than the two nasals. *Præocular.*—One, usually meeting the frontal. *Postoculars.*—Two. *Temporals.*—Two, the lower touching the 6th and 7th labials. *Supralabials.*—9, the 3rd, 4th and 5th touching the eye. *Sublinguals.*—Two pairs, subequal or the anterior rather largest, the posterior in contact with the 5th and 6th infralabials. *Infralabials.*—6, the suture between the 1st as long as that between the anterior sublinguals; the 6th much the largest, twice as broad as the posterior sublinguals, and in contact with three scales behind. *Costals.*—Two heads-lengths after the head 17, midbody 17, two heads-lengths before the vent 15. The reduction from 17 to 15 which occurs well behind the middle of the body is due to an absorption of the 3rd row usually into the 4th, rarely into the 2nd above the ventrals. The vertebrals are not enlarged, and the ultimate row but little if at all. Keels absent; apical pits present, and single (see D. of diagram). *Ventrals.*—177 to 212, Trichinopoly 188 to 202, Cannanore 177 to 203, Burma 180 to 200 Fyzabad 193 to 208, Dibrugarh 197 to 210, E. Himalayas 197 to 212, (178 to 224 Boulenger); angulate laterally. *Anal.*—Divided usually (rarely entire). *Subcaudals.*—56 to 80 (Boulenger); divided. *Anomalies.*—Very rarely the loreal is subdivided into two, an anterior and a posterior. Commonly the præocular fails to meet the frontal. The postoculars and temporals are sometimes three. Not infrequently, the supralabials are abnormal in number, *viz.*, 8 or 10, and the 3rd, 4th, 5th and 6th may touch the eye, either two, three, or all four of them. Rarely the nasal fails to touch the 2nd supralabial. Not infrequently the anal is entire, and rarely some of the subcaudals at the base of the tail. I have lately seen one from Tindharia in which the first 3 were entire, and Flower mentions one from Penang with the 4th and 5th entire.

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* Vol. X, p. 71. † P. Z. S., 1899, p. 664. ‡ Spol., Zeylan., Vol. I, p. 117.

Freaks are apt to occur among all animals, but that rare condition known as axial bifurcation or dichotomy, which gives rise to dual heads developed forkwise on the same body has been recorded at least three times in this species. I wrote[*] of one such specimen in this Journal and two others are reported as being in the Indian Museum by Sclater[†]. *Dentition.*—The *maxilla* supports an anterior and a posterior series of teeth. The anterior set number 5, the first 3 progressively increasing in size [‡], the last 2 about twice the length of the 3rd. An arched toothless gap intervenes between the anterior and posterior sets. The posterior set numbers 10 or 12, the last 2 are about twice the size of the preceding 8 or 10 which are subequal in size.

The *palato-pterygoid* array form an uninterrupted series of which the palatine numbering 11 to 13 are rather longer, the pterygoid numbering as many as 29 progressively and very gradually diminish in length from before backwards.

In preparing a skull the minute teeth at the back are very difficult to preserve, and dissect out intact, so that usually a number considerably less than 29 are evident.

Mandibular.—Consist of two series, an anterior and a posterior, separated by a short gap. The anterior contains 5 teeth, the 3 first progressively increasing in length, the 4th and 5th equal and about twice as long as the 3rd. The posterior set numbers from 16 to 20.

These figures are given from an examination of 4 skulls lying before me.

Günther's[§] statement that "Each maxilla is armed with two fangs in front, placed in a transverse line, the outer being much larger than the inner" is incorrect. The two fang-like teeth are subequal, and placed one behind the other. Similarly, the last *two* teeth in the posterior maxillary set are enlarged, not only the last as stated by him. Boulenger[¶] says the maxillary teeth increase in size posteriorly which seems to imply a gradual increase. This does not clearly describe the condition. It is the last two teeth which are suddenly and distinctly enlarged.

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[*] Vol. XVI. p. 387.

[†] List. Snakes, Ind. Mus., 1891, p. 14.

[‡] Only one is seen in my figure, the first two are not noticeable owing to the bending inwards of the maxilla.

[§] Rept. Brit., Ind. 1864, p. 316.

[¶] Cat., Vol. 1, p. 348.

SHAW'S WOLF-SNAKE (*LYCODON STRIATUS*).

Nomenclature—(a) Scientific.—The specific name *striatus* (Latin = striped) originated with Shaw in 1802. Russell had figured the snake prior to this in his work published in 1896.*

(*b*) *English.*—The English rendering of the specific title is not distinctive enough as it applies equally well to many others of the genus, so that I think "Shaw's Wolf-Snake" the most appropriate name for it.

(*c*) *Vernacular.*—The only names I know of are those given by Russell, *viz.*, Gajoo Tutta and Karetta the latter in Hyderabad, Deccan.

Dimensions.—The longest of 14 specimens measured of my own collection was 1 foot 3½ inches, and I know of no greater length.

Bodily configuration, etc.—Very similar to *aulicus*, the main difference being that the belly is not angulated on either side but evenly rounded from flank to flank. Boulenger calls the head of *aulicus* spatulate but not that of *striatus*. I cannot see much difference between the two, that of *aulicus* is perhaps rather flatter, and the snout more rounded. The eye is jet-black as in *aulicus*, the scales as glossy and the tips of the tongue white.

Colour.—Varying shades of dark-brown or black above with from 11 to 18 white cross bars on the body (not including tail) usually very distinct in the whole body length, the anterior ones specially so. The anterior ones again are more widely separated than the posterior. These bars are divided more or less distinctly at the sides to include a somewhat deltoid patch of the ground colour, very nicely shown in our plate. The belly is pearly-white, and unspotted. The head is brown or black above except the upper lip which with the lower lip, and chin is pearly-white. Most of the specimens I have seen have been a deep chocolate or pure black, and the cross bars pure white. Many writers, however, say that the bars or bands are yellow at any rate sometimes. Colonel Light in a letter mentions one caught at Bhuj with bright yellow cross bands, and says several in that locality have yellow bands. He mentions another from the same locality with the bands white. Stoliczka speaks of one from the Lower Hills of Simla with 58 broadish-yellowish cross bands. I have never seen a specimen with anything approaching 58 bands which in itself suggests *aulicus* rather than *striatus*. The ventrals 182 and subcaudals 57 would equally well agree with *aulicus*. Annandale* says that those from the Malakand are reported to have yellow marks. Green† mentions one from Peradeniya, Ceylon, with some of the median scales in the anterior white bands yellow, and Annandale* speaks of a similar specimen from Pamban in S. India.‡

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* Ind. Serp. I., Vol. I, Plates XVI and XXVI.

In 5 Ceylon specimens collected in Peradeniya, I found the bands far less distinct than in Indian forms, the colour being dirty white, and the ground colour brown rather than black.

Identification.—The remarks on *aulicus* under this heading apply also here. Attention must be given to the following: (1) a single loreal touching the internasal, (2) scale rows 17 in midbody (3) nasals touching the 1st and 2nd supralabials and (4) supralabials 7 or 8.

Haunts.—I have known this snake in the house, like its commoner ally *aulicus*, one in Fyzabad came into the Cantonment Hospital, and another was encountered in the Officers' Mess of the 85th K. S. L. I. Three or four were unearthed at different times during digging operations. It hides away during the day time in holes in the ground, heaps of debris, crevices of brickwork, stacks of wood, etc.

Disposition.—All the specimens I have seen alive exhibited a very timid disposition. I never knew one strike no matter what the provocation. Usually it made no endeavour to escape but coiled itself, and if touched or teased, hid its head beneath its coils, looking out cautiously from time to time to see if the danger apprehended had disappeared. It sometimes flattens itself to the ground in a remarkable way.

Habits.—Like the common wolf-snake it is decidedly nocturnal. I met with two at different times at night on the road between the Mess and my house at Berhampore (Orissa), and on both occasions there was no endeavour to retire from the situation, no attempt at menace. Except the specimens encountered while digging nearly all were killed at night. It does not appear to share the acrobatic attainments of *aulicus*, at least I have never known one leave the ground.

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* Mem. Asiat. Soc., Bengal, I. 10, p. 194.

† Spol. Zeylan., March 1905, p. 2 5.

‡ I know that *aulicus* and *striatus* are frequently confused one with the other, and I have found several specimens in various museums incorrectly identified. If one refers to the abnormalities in scaling that I have remarked upon in the two species in this paper, it will be apparent how easily a mistake may arise, since the points made use of in the separation of the two species are subject to some variation. Moreover, a mistake, I not infrequently committed in days gone by, may occur with others. It is very easy to miscount the upper labials in the *Lycodons*, and to omit to count the last which is often not so evidently one of the series as one sees in other snakes. In all cases the mouth should be opened, and these shields then counted to the gape.

Food.—Three of my specimens contained skinks in Fyzabad, of the species *Mabuia dissimilis.* I have no knowledge of its gastronomic tastes otherwise.

Breeding.—All I know of this is from my notes in Fyzabad.

The Sexes.—On two occasions in August pairs were found in company. In a small heap of kunkur by the side of a road a gravid female was dislodged one evening, and a male dislodged the next morning when the heap was broken further into. On the other occasion two snakes were seen together (not united) a little way beneath the soil during digging operations. Several coolies vouched for this, one of the snakes escaped in the excitement their discovery aroused, the other the male was captured, and in the hole were 4 eggs. It is remarkable I think that the partnership had not been dissolved even after the deposition of the eggs. The male organs are beset with numerous minute claw-like appendages.

The length of a gravid female of mine was 1 foot and ½ an inch. Mr. E. E. Green wrote to me some years ago of a gravid specimen which he identified as *aulicus* obtained by him at Peradeniya, Ceylon. I feel pretty certain that the specimen was not a Common Wolf-Snake, but Shaw's Wolf-Snake, for it was only 12 inches long, a length far more in keeping with what we know of *striatus*, and opposed to what we know of *aulicus*, the smallest gravid record of which is 1 foot 6½ inches. Of specimens I have sexed 7 were ♂ and 4 ♀, the longest specimen 1 foot 3½ inches being a female. The periods of gestation and incubation are not known.

Season.—Shaw's Wolf-Snake breeds at about the same season as the Common Wolf-Snake. I have known a gravid female with small eggs in July, one gravid with large eggs in August, and the deposited eggs alluded to above were found in August. Mr. Green's specimen was also gravid on the 30th August.

Eggs.—This species is not so prolific as *aulicus*, the eggs numbering from 2 to 4. They are very large for the size of the snake, and much elongate, I think, more so than those of *aulicus*. They vary from 1 to $1\frac{1}{5}$ inches in length, and are about $\frac{7}{20}$ of an inch in breadth. Otherwise they are just like those of the common wolf-snake.

Distribution—(a) Geographical.—This species extends further West than the Common Wolf-Snake, but not nearly so far East, its limit in this direction being proximately the longitude of Calcutta. It occurs throughout Peninsular India and Ceylon. On the West it extends through Sind and the Punjab, Baluchistan, and Persia to Transcaspia.

(*b*) *Local.*—Appears to be chiefly a snake of the Plains, extending to low hills to about 2,000 feet.

(*c*) *Numerical.*—Though I think it has claims to be considered one of the common snakes of India, it is not nearly the common snake that its ally *aulicus* is. In Fyzabad I got 13 specimens out of a total of 704, but whether it is more plentiful there than in other parts, I cannot say. I saw 3 or 4 specimens in the few months I was stationed at Berhampore (Orissa).

Lepidosis. Rostral.—Touches 6 shields; the rostro-nasal suture longest. *Internasals.*—Two, the suture between them $\frac{1}{2}$ to $\frac{2}{3}$ that between the præfrontal fellows, about equal to the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them distinctly greater than the præfronto-frontal; touch the internasals, loreal, præocular, supraocular and frontal. *Frontal.*—Touches 6 shields, the supraocular sutures longest. *Supraoculars.*—$\frac{2}{3}$ the length, $\frac{1}{2}$ or less than $\frac{1}{2}$ the breadth of the frontal. *Nasals.*—Quite divided by the nostril: touch the 1st and 2nd supralabials. *Loreal.*—One, about as long as the nasals taken together; in contact with the internasals. *Præocular.*—One, not touching the frontal. *Postoculars.*—Two. *Temporals.*—Two anterior. *Supralabials.*—8 normally, the 3rd, 4th and 5th touching the eye. *Sublinguals.*—Two pairs, the posterior rather shorter and in contact with the 5th and 6th infralabials. *Infralabials.*—6; the 6th largest, twice or nearly twice as broad as the posterior sublinguals, in contact with 3 scales behind; the suture between the 1st about equal to that between the anterior sublinguals. *Costals.*—2 heads-lengths from head 17, midbody 17, 2 heads-lengths before vent 15; the reduction from 17 to 15 occurs well behind the middle of the body and is due to a confluence of the 3rd and 4th rows above the ventrals usually, sometimes the 4th and 5th; keels absent; apical pits present, single; the vertebral row not enlarged; the ultimate not or barely enlarged. *Ventrals.*—Not angulate; 153 to 178 (Boulenger) one of my Fyzabad examples 179, one in the Indian Museum from Malakand 179, another from the Perso-Baluch Frontier 196. Stoliczka's specimen from below Simla with 182 I consider an *aulicus*. *Anal*—Divided. *Subcaudals*—Divided, 42 to 66 (Boulenger). In two Ceylon specimens I count 35 and 39. Russell's two specimens 40 and 41, the latter from Hyderabad, Deccan.

Anomalies.—In a specimen in the Indian Museum from Malakand the loreal is dual on both sides, the anterior small shield touching the internasal and make these shields appear as four. The nasals occasionally touch the 1st only of the supralabial series. The anterior temporal is rarely a single shield. The supralabials are rarely 7 with the 3rd and 4th touching the eye, 8 with the 4th and 5th touching the eye, or 9 with the 3rd, 4th and 5th touching the eye. I have found the anal entire in one Ceylon specimen, and in Russell's Plate (XXVI) this shield is shown entire.

Dentition.—Very similar to that of *aulicus*. *Maxilla.*—This supports an anterior and a posterior set separated by a considerable edentulous interval. The anterior has 2 (3 ?) progressively increasing teeth, followed by two large subequal teeth as in *aulicus*. The posterior set has 4 subequal small teeth followed by two large subequal ones.

Palato-pterygoid.—The palatine bone supports 11 teeth, the pterygoid I cannot give, believing my only skull to be imperfect. Both sets are small and subequal. *Mandibular.*—Anteriorly 3 progressively increasing small teeth followed by two subequal large ones, then a short gap sufficient to accommodate one tooth, followed by 13 small subequal teeth.

In this species the *maxilla* is distinctly shorter than in *aulicus*, supporting 4 small teeth in the posterior set instead of 8 to 10. The two enlarged posterior teeth are situated beneath the middle of the eye, and at a point well in advance of the optic foramen in the cleaned skull. In *aulicus* these two large teeth are exactly opposite the optic foramen, and beneath the back of the eye. In the mandible there are fewer teeth (13) than in *aulicus* (16 to 20.)

(*To be continued*).

A LIST OF THE BIRDS OF THE BHAMO DISTRICT, UPPER BURMA.

BY

MAJOR H. H. HARINGTON (92nd PUNJABIS).

The Bhamo District of Upper Burma lies roughly between the twenty-fourth and twenty-fifth degrees of latitude, and is bounded on the East by China, and contains a great variety of country consisting of the Irrawaddy Valley, low-lying hills, and on the East a series of ridges running up to 6 000 feet.

The country to the West of the river, very broken and covered with dense forest, is practically unexplored. On the East the plains near the river are more or less cultivated, the ground gradually rising into a terai of heavy tree jungle. From this, the hills rise abruptly, range behind range, to the borders of China. On their western slopes they are covered with dense evergreen jungle, which, towards their summit, have at some time or other been cleared for cultivation (toungyas) so giving rise to a thick secondary growth, now very difficult to penetrate. On the eastern slopes where the rainfall is not so great, the oak and chestnut flourish. The hills suddenly drop into the Loijè Valley, through which runs the Chinese frontier—the country being almost devoid of trees and covered with bracken and brambles.

The District is consequently very rich in bird life, and must still contain a number of rich prizes, as many of the higher hills have yet to be explored.

I have compiled this very incomplete list from birds collected by myself during a short stay in these hills, as well as from a list kindly given me by Colonel G. Rippon, I. A., and from the list of Mr. E. W. Oates in the Ibis of 1888 and of Count Salvadori in the "Annali del Museo civico di Storia Naturale, Genoa," Vol. IV, Second Series, pages 568 to 617.

I spent a very pleasant and profitable two months of my leave collecting in the hills due East of Bhamo, one month being spent at Sinlum-Kaba a small hill station of about 5 500 feet above sea level. I was fortunate in getting many birds not previously recorded within Indian limits, as well as four new Sub-species, besides many rare and interesting eggs.

My thanks are due to Mr. Ogilvie-Grant for kindly assisting me in identifying my specimens and in helping me with their descriptions, and to Mr. E. W. Oates for his encouragement and help in making out this list.

I have taken the liberty of giving the descriptions of those birds not mentioned in the "Fauna of India," with a hope they may be of assistance to others, as I found it a great drawback whilst collecting not to be able to recognise the different birds.

All species actually collected and identified with those in the Natural History Museum are marked with an asterisk.

CORVIDÆ.

(4) CORVUS MACRORHYNCHUS, Wagl. —(The Jungle Crow.)

Common everywhere in the plains, a good many finding their way up into the Hills, where, however, they are very wild and keep well to the jungles.

(8) CORVUS INSOLENS, Hume.—(The Burmese House-Crow.)

Common round villages along the river, and a positive nuisance at Bhamo itself. Does not penetrate into the jungles, but re-appears in the Loijè Valley on the Chinese frontier. This is probably one of its most easterly limits.

*(10*b*) PICA SERICEA, Gould.—(The Chinese Magpie.)

Hartert Vog. Die Pal. Fauna, page 22.

(*Trans.*) "Distinguished by the dark colouring of its tail and wings. The black at the base of the primaries and primary coverts being very much extended : the primaries are also almost blue and not a bright green. The middle tail feathers almost steel blue, seldom green. Legs and feet very strong. Rump patch always present, generally gray, rarely white.

From Upper Burma, through China into South Japan, Hainan, Formosa, northwards into Korea."

The Chinese Magpie's nesting habits seem to be identical with the home bird, building the same massive domed nest, which however seems bigger, most probably due to the same nest having been used for many successive years. They are early breeders, beginning nesting operations in January, and by the middle of March the eggs are either very much incubated or the young birds hatched out. The eggs are very like those of the home bird, but seem more baldly marked, six seems to be the full complement.

Very common along the Chinese frontier. I have also seen birds at Bhamo where a pair used to breed in the Military Police Fort : a pair have started building near their old site.

Nesting.—At Loijè on the 29th March I found a nest in a small peepul tree On sending up a coolie a cock Koel flew out of the tree, as well as a Magpie from the nest. As the Koel had been continually calling during our stay there I had hopes of again getting their eggs from a Magpie's nest, and sure enough, when the coolie descended he brought down four Magpie's and two Koel's eggs. I have previously taken the Koel's eggs from a Magpie's nest in the Shan States, where Magpies are extremely common. I saw several other Magpies' nests and got their eggs.

(12) UROCISSA OCCIPITALIS, Blyth.—(The Red-billed Blue Magpie.)

Well distributed in suitable jungle, both in the hills and plains.

(14) CISSA CHINENSIS, (Bodd).—(The Green Magpie.)

Saw several on the lower slopes of the Hills, accompanying flocks of Laughing Thrushes.

Nesting.—On the 25th April I was very fortunate in getting a fine clutch of seven eggs in a valley below Sinlum. The nest was placed in a very tall thin sapling, so that the only way of getting it was by cutting the tree down in sections, so telescoping it until the nest could be reached. As the eggs are all exactly similar I think they must have been laid by the same bird.

(16) DENDROCITTA RUFA, (Scop.)—(The Indian Tree-Pie.)

Common in the plains round Bhamo.

*(18) DENDROCITTA HIMALAYENSIS, Blyth.—(The Himalayan Tree-Pie.)

Well distributed in the Hills.

*(25) GARRULUS LEUCOTIS, Hume.—(The Burmese Jay.)

One specimen, procured in oak forest at M'ba Kha, south of Maiput. This bird probably extends into China.

PARINÆ.

(31) PARUS ATRICEPS, Horsf.—(The Indian Grey Tit.)

Recorded by Oates in "The Fauna of India." Probably found in the plains round Bhamo.

*(32 *i*) PARUS COMMIXTUS, Swinhoe.—(The Chinese Grey Tit.)

Hartert Die Vog. Pal. Fauna, page 346.

Kachin name.—Bainum numkha.

(*Trans.*)—"Like P. minor but much smaller. Wing only about 65—70 m.m. The olive green of the back more extended, and the edge of the wings duller, being a dirty cream or brownish grey colour.

South China to Upper Burma and East Tenasserim, etc."

All my specimens collected at Sinlum are nearest to this species in having a green back, and the white on their tails like *P. atriceps*, and I think therefore should be called *P. commixtus.*

Nesting.—I found three nests on the 22nd, 25th and 28th April. All were placed in holes in the side of the cutting along the road below Sinlum. The nests were composed of moss lined with feathers and fur, and contained four, five and four eggs. In the beginning of May I saw several parties of young birds about.

Eggs.—Of the usual tit type, being white, and rather boldly spotted with rusty red.

Measuring.—Average of six eggs ·66 × ·52; largest—·67 × ·53, smallest—·64 × ·53.

* (36*b*) ÆGITHALISCUS TALIFUENSIS, Rippon.—(The Yunnanese Red-headed Tit.)

Bull, B. O. C., Vol. XIV, p. 18.

Kachin name.—Shiraw Sik.

(*Trans.*) "Similar to *A. manipurensis* and *A. concinna* (the Chinese bird). Top of the head pale rufous, but the band across the chest narrow, and the sides of the body very deep chestnut. Length 4·5; culmen ·35; wing 2·1; tail 2·1; tarsus ·65."

My specimens from Sinlum seem to be slightly smaller than Col. Rippon's birds in Nat. Hist. Museum.

Nesting.—On the 28th April I was at last fortunate in finding the nest of this little Tit after having watched and hunted in vain since the 20th, when I had seen a bird with a feather in its beak. The nest was placed between the stems of a bramble about two feet from the ground, and reminded one of a small English Long-tailed Tit's nest. On the outside it was composed entirely of moss (not covered with lichen), the entrance hole being near the top, and was lined firstly with vegetable down and then profusely with gaudy feathers of the Pheasant, Hill Partridge, Barbets and Minivets, and contained three highly incubated, but blowable eggs. I also found another nest building which seems to be a very lengthy operation, as I watched it for over a fortnight while the birds thought of completing it. At last, when I had hopes of obtaining a nice clutch of eggs, I found something had been before me and had pulled it to pieces, as well as a Stachyrhidopsis's nest close by, which should also have contained eggs.

I got a fully fledged young bird of this species at Sinlum; it has the black throat of the adult bird altogether wanting, its whole throat and upper breast being entirely white, with the exception of a thin black gorget which is never found in the old bird. In the Nat. Hist. Museum there is a young bird of *A. concinna* showing markings very similar to my specimen.

Eggs.—Very like those of *Æ. erythrocephalus*, but much smaller, having a white ground colour with a zone of minute reddish purple spots round the larger end.

Measuring.—Average of three eggs ·55 × ·44; largest ·57 × ·44; smallest ·52 × ·44.

*(41) MACHLOLOPUS SPILONOTUS, (Blyth.)—(The Black-spotted Yellow Tit.)

Kachin name.—Bainum numkha (same as *P. commixtus.*)

Fairly common in the Hills.

All the females collected by me want the conspicuous black band down the breast, and were easily distinguishable from the males. I failed to find a nest, but had two eggs and the nest brought me by a Kachin.

Eggs.—White, profusely spotted with rusty red, and measure ·74 × ·58.

PARADOXORNITHINÆ.

* (52) PARADOXORNIS GUTTATICOLLIS, David.—(Austen's Crow-Tit.)

Kachin name.—Re- h ng-nu-gop.

Saw this bird on several occasions frequenting patches of mountain-bamboo and high grass but failed to find its nest. It has a series of very fine loud notes when disturbed, and is thus easily recognizable.

° (6) Suthora poliotis, Blyth.—(The Ashy-breasted Crow-Tit.)

Very tit-like in its habits, going about in parties with *Ægithaliscus*. I think they must be late breeders, as I failed to find any indications of their nesting.

(59) Suthora atrisuperciliaris, (Godw.-Aust.)—(The Black-browed Crow-Tit.)

Recorded by Col. Rippon.

° (59*a*) Suthora brunnea, Anders.—(Anderson's Crow-Tit).

Very plentiful in the Hills at about 5,000 feet; and before the breeding season commences goes about in small parties, haunting low trees and bushes; later on keeps entirely to grass and bracken.

I found several nests, all were placed within two feet of the ground generally in a clump of grass or rushes, rarely on a bramble, and were always well hidden and only found by seeing the bird fly out. The nest is a very compact cup made of bamboo leaves and grass, occasionally having a little moss on the outside. Three seems to be the complement of eggs, rarely two. I found one nest containing four fresh eggs.

Eggs.—A pale blue. Average of nine eggs ·64 × ·52; largest ·69 × ·53; smallest ·60 × ·50.

As some of my birds run very near *Suthora styani*, Ripp. Bull., B.O.C., XIII, p. 54, I here give a description of it.

(*Trans.*) "Similar to *S. brunnea*, but paler. Underparts very pale throat and chest white, not vinaceus, with conspicuous reddish-brown stripes."

CRATEROPODINÆ.

Kachin name for all Laughing Thrushes, Wo-Krang.

(62) Dryonastes ruficollis, (Jard. and Selby)—(The Rufous-necked Thrush.)

Recorded by Col. Rippon.

° (66*a*) Dryonastes kauriensis, Ripp.—(The Kachin Hill Laughing Thrush.)

Bull., B.O.C., Vol. XIII, p. 13.

Kachin name.—Wo-Krang-Krang-Frong.

(*Trans.*) "Similar to *D. subcærulatus* (Hume), and with tail feathers tipped with white, but the cheeks reddish-brown, uniform and less white."

Total length about 11·3, culmen 1·05, wing 4·1, tail 4·55, tarsus 1·6.

Orbital skin and bare-naked patch round the eyes slaty-blue.

A very handsome bird with its rich brown colouring and white breast. It has a very fine almost human whistle which can be easily imitated and the bird called up. It generally keeps to dense jungle.

Nesting.—My Burman collector found a nest containing two incubated eggs, shooting parent bird. The nest was placed on a small mountain-bamboo and was of the usual type, being made entirely of bamboo leaves lined with fine grass and measured 6″ × 5″ outside and 3½″ × 2½″ inside.

Eggs.—A bright glossy blue, rather long and pointed, measuring 1·26 × ·84.

* (67) Dryonastes sannio, (Swinh.)—(The White-browed Laughing Thrush.)

Kachin name.—Shong-shay, and Wo-Frow.

Is the commonest bird of its family in the Hills, and very noisy in the mornings and the evenings with its harsh complaining notes.

Nesting.—It is an early breeder ; many nests found in April had young birds. All the nests found by me in the Kachin Hills were placed near the ground, either in bramble bushes or in thick grass, and not in saplings as those found in the Southern Shan States.

It lays two types of eggs, the commonest being a pale blue-green, the other which seems to be laid later in the season, a pure glossy white.

Eggs.—Of two types, one a glossy pale blue-green, the other a very glossy white. Average of ten eggs 1·04 × ·75, largest 1·08, smallest ·97 × ·76. The eggs have an unmistakable shape, being rather blunted at the small end.

(69) Garrulax leucolophus, (Hardw.)—(The Himalayan White-crested Laughing Thrush.)

Recorded by Col. Rippon.

(70) Garrulax belangeri, Less.—(The Burmese White-crested Laughing Thrush.)

Recorded by Mr. Oates.

I saw several birds of one or other of the above in the low hills when out after pheasants but did not collect any specimens. They do not seem to extend up the hills to any height.

(72) Garrulax pectoralis, (Gould.)—(The Black-gorgeted Laughing Thrush.)

Only found in the lower hills.

(73) Garrulax moniliger, (Hodgs.)—(The Necklaced Laughing Thrush.)

Recorded by Salvadori. Have since procured it near Bhamo Station.

* (81*c*) Babax yunnanensis, Ripp., Bull. B. O. C., Vol XII, page 96.

(*Trans.*) " Like *B. lanceolato*, but cheek-stripe at the base of the bill chestnut, not black. Total length about 10·3, culmen 1·1, wing 3·6, tail 4·35, tarsus 1·35."

This is decidedly a rare bird, the Kachins not having any name for it. It seems to prefer more or less open hill-sides covered with brambles and grass. I found three nests, that on the 23rd April containing four eggs, the 1st May three eggs, the 7th May four eggs, securing the parent bird on each occasion. The nests were all similarly placed near the ground in bramble bushes on a more or less open hill-side, and were of the usual babbler type.

Eggs.—A rich blue matching in colour some eggs of *T. squamatum* I have from Assam. Average of nine eggs 1·06 × ·8, largest 1·14 × ·85, smallest 1·04 × ·75.

Babax lanceolatus, (Verr.)—Cat. Birds, Vol. VII, p. 352.

· Above streaked, the general colour being dark chesnut-brown and ashy, the margins of the feathers being of the latter coloured ; rump and upper tail-coverts more uniform ashy-brown, the central streaks being not so marked; wing-coverts coloured like the back, except the bastard-wing feathers which are dusky-brown edged with ashy ; primary-coverts uniform brown ; quills brown, the primaries slightly margined with ashy, the inner secondaries more rufous-brown, and with plainer ashy margins ; tail olivaceous-brown, with indistinct cross-bars under certain lines ; crown of head chestnut-brown, nape and sides of neck streaked like the back, but the edges of the feathers rather clearer and more hoary-grey ; lores and feathers in front of the eye fulvous-brown ; ear-coverts, as well as a tolerably broad eye-brow, hoary-white spotted or streaked with dark-brown ; cheeks blackish (very dark-chestnut ?) the hinderpart mottled with chestnut-brown edged with hoary-white ; throat and undersurface of body buffy-white, a little purer on the breast and abdomen ; the fore neck and breast streaked with nearly obsolete shaft lines of black ; the sides of the breast and flanks broadly streaked with chestnut, relieved by a black streak down the centre of the feathers; sides of vent and thighs brown with dusky streaks ; under tail-coverts more fulvescent with dusky-brown centres ; under wing-coverts fulvous-brown streaked with chestnut ; quills ashy-brown below strongly washed with pale rufous along the inner web ; bill brown, feet and claws grey, iris pale yellow." (David).

Total length 10·8 inches, culmen 1·05, wing 3·75, tail 5, tarsus 1·5.

(85) TROCHALOPTERUM NIGRIMENTUM, Hodgs.—(The Western Yellow-winged Laughing Thrush.)

Recorded by Col. Rippon.

*(86*a*) TROCHALOPTERUM SHARPEI, Ripp.—(Sharpe's Laughing Thrush.)

Bull : B. O. C., Vol. XII, page 13.

(Trans.) "Similar to *T. milnei*, but with the cheeks pale-grey and less white."

Length 11·5, culmen 1·2, wing 4·1, tail 4·7, tarsus 1·5.

Orbital skin blue.

Kachin name.— Wo-krang-krang-sheng, and Krang-sheng-kaba.

TROCHALOPTERUM MILNEI, David. Cat. of Birds, vol. vii, p. 372.

" Adult male : crown of head and upper part of neck of a buffy-rufous colour : ear-coverts pure white ; throat and lores black ; back olive, with the large feathers edged with a dark border ; rump and upper tail-coverts of a golden-olive tint ; lower parts ashy-olive passing to greenish on the neck, breast, flanks, under tail-coverts and tibial plumes ; upper surface of the tail bright red, lower surface blackish ; quills above brilliant and glossy red with the inner webs of the innermost secondaries white ; bill and feet black ; iris brown. (David and Oustelet).

Adult female like the male."

A very handsome bird, but a great skulker, fond of dense secondary jungle.

Nesting.—On the 29th April I found one nest containing three eggs. The nest was placed against the side of a tree three feet from the ground, and of the usual type, made of bamboo leaves lined with roots; measured 4½″ × 6½″ outside and 3″ × 3½″ inside. I also got two other nests of the same description, securing the birds.

Eggs.—Lays two or three glossless white eggs spotted with dark red, with underlying purple spots very like those of an oriole, and quite different from any other Laughing Thrushes' eggs that I have seen. Average of eight eggs 1·13 × ·82; largest 1·3 × ·8, smallest 1·07 × ·8.

*(87a) Trochalopterum ripponi, Oates.—(Rippon's Laughing Thrush.) Bull: B. O. C., Vol. XI., page 10.

Kachin name.—Krang-sheng-maling (Krang-sheng for both *T. Sharpei* and *T. Ripponi.*)

"Allied to *T. phœniceum* from the Himalayas, but differing from that species in many important points. The crimson of the head is much brighter and extends to the whole of the sides of the head, the supercilium, forehead, chin and cheeks, even tinging the throat. The latter, together with the whole lower plumage, is greyish-yellow not fulvous-olive-brown. The whole crown is dark plumbeous and the remainder of the upper plumage with the wing-coverts is olive-grey. The tail feathers are not tipped with orange, but more narrowly with ochraceous, the lower aspect of the outer feathers alone being orange."

Wing 3·4, tail 4, tarsus 1·3.

Nesting.—Fairly common, noisy, and a great skulker. It builds the usual type of nest, either in the thorny bush, bamboo or small sapling, from three to five feet from the ground, and lays three eggs similar to those of *T. Phœnicium* being blue spotted and streaked with dark red. Average of six eggs 1·01 × ·75, largest 1·1 × ·72, smallest 1·0 × ·76.

*(92) Trochalopterum squamatum, (Gould).—(The Blue-winged Laughing Thrush.)

Kachin name.—Wo-krang-krang-frong, the same as *D. kauriensis.*

Decidedly rare, and fond of valleys covered with dense jungle. On the 30th April I found a nest of this bird, containing three eggs, and shooting the parent bird. The nest was placed in an over-hanging bush on the side of a deep valley, and was of the usual type.

Eggs.—My eggs are much smaller and of a paler shade than those I have from Assam, measuring—

1·09 × ·84
1·04 × ·81
1·05 × ·81

(104) Argya earlii, (Blyth).—(The Streaked Babbler.)

Common round Bhamo near the banks of the river, especially so in the grass and wild-rose jungle at the bottom of the polo ground, where it breeds during May.

*(125) **Pomathorinus ruficollis**, Hodgs.—(The Rufous-necked Scimiter Babbler.)

I got three specimens which, I think, must belong to this species, and one which is slightly smaller, with white tips to its tail feathers and primaries and with faint white bars across the rump ; as the markings are so extraordinary I think it must be a "sport."

I did not find any nests of this bird, but saw old ones carrying food early in April.

*(130*a*) **Pomathorinus gravivox**, David.—(David's Scimiter Babbler.)

Oust. Bul. Mus. Paris, 1898, p 255.

Kachin name.—Che-ba-wo-graw.

Differs from *P. Macclellandi* by having its upper plumage of a more greenish tinge and the stripes on the throat black instead of grey, the sides of its body and flanks being a rich chestnut instead of olive-brown.

In the "Ibis" of 1891, p. 373, Seebohm notes the differences between *gravivox* and *Macclellandi.*

Fairly common, and very noisy in the mornings and evenings, having a fine blackbird-like song of a few notes which it repeats often.

Nesting—I found several nests of this bird ; all were domed, and placed near or on the ground. They seem to be early breeders, as the first nest I found was on the 10th April, with two eggs on the point of hatching. I also saw many young birds about during the month.

Eggs.—A glossless white. Average of nine eggs 1·07 × ·87, largest being 1·17 × ·78, smallest 1·03 × ·8.

TIMELIINÆ.

(134) **Timelia jerdoni**, Walden—(Burmese Red-capped Babbler.)

Recorded by Col. Rippon ; plentiful in grass jungle round Bhamo.

(139) **Pyctorhis sinensis**, (Gm.)—(The Yellow-eyed Babbler.)

Recorded by Col. Rippon.

* (141) **Pyctorhis altirostris**, (Jerd.)—(Jerdon's Babbler.)

Two specimens. Very plentiful round Bhamo. Hope to procure eggs later in the season.

(143) **Pellorneum minus**, Hume.—(Sharpe's Spotted Babbler.)

Recorded by Col. Rippon.

I heard either this bird or *P. subochraceum* calling continually at Bhamo, but did not procure specimens.

*(148*a*) **Drymocataphus cinnamomeus**, Ripp.—(Rippon's Babbler.)

Bull. B. O. C Vol. XI, p. 12.

(Trans.) "Similar to *D. ignotum*, but the throat distinctly spotted with rufous and abdomen white."

Length: 5, culmen ·55, wing 2·15, tail 1·75, tarsus 1 8.

Bill dark horn, lower mandible paler. Iris orange red, legs pale horn. Its breast is also distinctly more rufous.

Nesting.—This is decidedly a rare bird and a great skulker, as I only came across it twice. At Sinlum on the 6th May a Kachin pointed me out a nest containing three eggs which was quite new to me, so I sat down to get the parent bird, but although the bird came continually, owing to the denseness of the jungle, I could not secure it that day. Once two birds came together, one going to the nest, the other sitting above, so I fired at the latter; which I found to be *I. flavicollis.* On looking above I found it had its nest, which unfortunately contained two young birds. I returned the next day, and after many fruitless attempts I was at last successful in getting the hen bird of *D. cinnamomeus* as she left her nest. The nest was placed in long grass about two feet from the ground, under some overhanging bamboos, and was dome-shaped, made of woven grass, and reminded one rather of a large edition of a *Suya's* nest. I was glad to see that the hen *Ixulus* had taken on the rearing of her family single-handed, as she came regularly every few minutes while I was watching, and was not the least afraid.

Eggs.—Very like those of *D. ignotum* in the Museum, being a pinkish colour profusely speckled all over with rusty-red, which forms a zone round the larger end, and measure ·84 × ·56.

*(163*a*) ALCIPPE FRATERCULA, Ripp.—(The Shan Hills Babbler.)
Bull. B. O. C., Vol. XI, p. 11.

Kachin name.—Ching-tong-wo-lee.

(Trans.) "Similar to *A. nepalensis*, but larger and altogether darker; head grey, and not vinaceous."

Total length about 5·8, culmen ·55, wing 2·65, tail 2·6, tarsus ·8.

Nesting.—A very noisy and inquisitive little bird, and so can be easily called up. On the 18th April I found a nest containing two highly incubated eggs and procured the parent bird. The nest was placed on a bramble in long grass about three feet from the ground, and was composed of fern leaves and grass, lined with some sort of red fibre, and measured 4″ × 1½″ inside. I also found another nest containing two eggs. This was in a much more open situation, under a clump of trees and about four feet from the ground, and composed almost entirely of moss.

Eggs.—Something like those of *A. nepalensis* in the Museum, having a white ground colour, and spotted with rusty-red forming a zone round the big end, the largest egg measuring ·87 × ·58, the smallest ·77 × ·57.

*(169) STACHYRHIS NIGRICEPS, (Hodgs.)—(The Black-throated Babbler.)
One specimen procured.

*(170) STACHYRHIS CHRYSÆA, Hodgs.—(The Golden-headed Babbler.)
One specimen.

*(171). STACHYRHIS ASSIMILIS, Wald.—(The Allied Babbler.)
One specimen procured, at the same time and place as the last, of which I thought it was the female as both, as well as others, were hunting together.

(173*a*) STACHYRHIDOPSIS SULPHUREA, Ripp. Recorded by Col. Rippon.

* (173*a*) STACHYRHIDOPSIS BHAMŒNSIS, Harington.
(Anns. and Mag. of N. H. Ser. 8, Vol. II, Sept. 1908).

Adult male.—Resembles *S. sinensis*, Grant, in having the light chestnut on the head confined to the crown and not extending over the nape, but may be easily recognized by its much larger and more massive bill. It differs in having faint black shaft-streaks to the feathers of the forehead, the throat less yellow, much the same colour as the breast, which is a dull greyish-olive, and the sides of the head and neck grey instead of yellowish.

Total length about 4·6 inches ; exposed part of culmen 0·5 ; wing 2·1 ; tail 2·2 ; tarsus 0·8.

Adult female.—Similar to the male.

Habitat—Sinlum-kaba, Bhamo District, Upper Burma.

Fairly common ; ten specimens were procured.

Nesting.—A very noisy little bird during the breeding season, drawing attention to itself if anyone invades its own particular patch of jungle. It builds an untidy retort-shaped nest entirely of bamboo leaves, which it places in clumps of long over-hanging grass. It is always very well concealed and can only be found by seeing the bird fly out ; eggs generally three in number ; one nest I got, however, with four.

Eggs.—Pure white, with a few pale red spots forming a zone round the larger end, one clutch of four have however a only very few spots, one egg being almost entirely white. Average of seven eggs ·65 × ·52, longest ·69 × ·5, smallest ·61 × ·55.

(176) Mixornis rubricapillus, (Tick.)—(The Yellow-breasted Babbler.)

Recorded by Col. Rippon.

*(179*a*) Schœniparus intermedius, (Ripp.)—(Rippon's Tit-Babbler.)

Bull, B. O. C., Vol. XI, p. 11.

Kachin name—Prep-dor.

(Trans.) " Like *S. mandelli*, and with sides of the neck streaked with black, the throat and the middle of the belly whitish and not fawn colour. "

Nesting.—It builds an untidy dome-shaped nest on or near the ground and lays three eggs like those of the family, being white and smugged all over with earthy brown, and over this a few irregular dark-brown spots, and measure about ·8 × ·6.

*(182) Propaprus castaneiceps, (Hodgs.)—(The Chestnut-headed Tit-Babbler.)

One specimen.

*(198) Drymochares nepalensis, (Hodgs.)—(The Nepal Short-wing.)

One specimen.

(201) Tesia cyaniventris, Hodgs.—(The Slaty-bellied Short-wing).

Recorded by Col. Rippon.

*(202) Oligura castaneicoronata, (Burton.)—(The Chestnut-headed Short-wing).

One specimen.

SIBIINÆ.

(205) Lioptila gracilis, (McClell.)—(The Grey Sibia.)

Recorded by Col. Rippon.

*(208) Lioptila annectens, (Blyth.)—(Blyth's Sibia.)

One specimen.

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* (211*b*) ACTINODURA RIPPONI, (Grant.)—(Rippon's Bar-wing).
"Ibis," 1907, p. 186.
Kachin name—Pong-prap.

	Egertoni—Gould.	*khasiani*—(G.A.)	*Ripponi*—Grant.
Forehead.—	Dark chestnut, extending on to crown.	Rufous, not extending beyond eye.	Rufous, usually not extending beyond eye.
Crown.—	Dark ash-grey.	Light ash-grey.	Dark ash-grey.
Back.—	Reddish olive.	Ochraceous.	Greyish olive.
Middle tail-feathers.—	Dark bars, usually very faint.	Dark bars, usually distinct.	Dark bars, usually distinct.
Distribution.—	Nepal, Sikkim, Dafla Hills, Shengorh Peak.	Shillong, Naga and Khasia Hills, Munipur.	Mt. Victoria, Chin Hills.

These three forms may be easily separated by the colour of their back.

My specimens agree nearest with *A. ripponi*, although they are geographically the furthest away from that species. One specimen, of which I have got the eggs, running very near *A. khasiani*.

Nesting.—I found a nest of this bird building and saw both birds, but returning when I expected to find eggs I found something had been before me. The nest was placed in a small sapling in rather a conspicuous position, and as far as I could see was composed chiefly of moss. My Burman collector was, however, more fortunate, in getting two nests at the end of April with the parent birds, each nest containing two incubated eggs. Both were placed in bamboos and were deep cups having a mossy foundation and composed of bamboo leaves and roots, lined with fine grass, and measured 4″×5″ outside, and 2½″×2¾″ (deep) inside.

Eggs.—Are very handsome, being a bright blue, spotted and marked with lines of brown, and have indistinct underlying purplish markings; and measure ·9×·66.

* 217. STAPHIDIA RUFIGENIS, (Hume).—(Hume's Staphidia)

One specimen.

* (222*a*) SIVA WINGATEI, (Grant.)—(Wingate's Siva.)
Bull. B. O. C., Vol. X, p. 38.
"Ibis," 1900, p. 593.

Kachin name—Ching-Tong wu-lee same as *A. fratercula.*

"*Adult male*—Closely allied to both *S. cyanuroptera*, Hodgs. and *S. sordida*, Hume. It resembles both in general colour of the upper parts, the grey of the head and back shading into olive-brown on the back and fulvous on the rump and upper tail-feathers. It further resembles *S. cyanuroptera*, and differs from *S. sordida,* in having the chin, throat, sides and flanks washed with vinous grey. It differs from *S. cyanuroptera,* and resembles *S. sordida* in having no white tips to the bastard wing feathers. It differs from both in having only the inner webs of the outer pair of tail-feathers white to the tip moreover the feathers on the forehead, lores and chin are strongly washed with rusty pink, though it is just possible that this colour may be due to stain. Irish brown ; total length 6, wing 2·5, tail 2·5, tarsus 0·9.

* (225*a*) YUHINA AMPELINA, (Ripp.)—(The White-creasted Yuhina.)

Bull. B. O. C. Vol XL, p. 12.

Kachin name—Chee-chaw pum-frong, Chee-chaw, and Pum-chee-chaw.

(Trans). "Like *Y. diademata* but darker. The sides of the face greyish-brown, cheeks streaked with pale brown, breast greyish and not brown, abdomen and under tail coverts white.'

Iris dark brown, bill horny yellow, paler below, legs orange-yellow.

When excited it raises its crest, the white under-feathers becoming very conspicuous, giving it a white-capped appearance.

YUHINA DIADEMATA, J. Verr , Cat. of Birds, Vol. VII, p. 632.

"*Adult male.*—General colour above uniform earthy brown, the crest of the same colour with lighter shaft-streaks, and separated from the nape by a broad line of silky white feathers which encircle the occiput, starting from above the eye ; wing-coverts like the back ; bastard-wing and primary-coverts dark brown ; quills black with brown shafts becoming white towards their ends ; the primaries edged with whitish towards their tips : tail-feathers brown, dusky on the inner web and towards the end, the shafts white ; forehead dark brown above crown; lores black ; eye-lid white ; sides of the face and ear-coverts brown, the latter with whity-brown shaft-streaks ; the anterior part of the cheeks darker brown ; under surface of body earthy-brown, paler on the flanks, the chin and upper throat dark brown; centre of abdomen and under tail-feathers white ; auxilliaries and under wing-coverts white, those near the edge of the wing brown forming patch ; quills blackish below, white along the edge of the inner web. Bill and feet yellow, iris clear chestnut. West China and Eastern Tibet.

Nesting.—Rather a common bird at Simlum Kaba ; and has very tit-like habits and call, and is altogether a conspicuous bird from its white crest. I found several nests during my stay in the Hills, the first on the 16th April. All the nests I found were placed in bramble bushes within three to four feet of the ground, and were very flimsy affairs, being quite transparent, and were made entirely of black roots. Two seemed to be the usual complement of eggs ; I only found one nest with three.

Eggs.—Very like small *C. saularis,* being a greenish-blue profusely spotted with umber brown. Average of seven eggs ·76 × ·60, largest ·8 × ·6, smallest ·75 × ·58.

* (226) ZOSTEROPS PALPEBROSA, (Temm.)—(The Indian White-Eye.)

Not uncommon in the Hills. I found three nests.

*(232) Ixulus flavicollis, (Hodgs.)—(The Yellow-naped Ixulus.)

Kachin name.—Chee-chaw (only.)

Fairly common in the hills, and is a most amusing little bird, continually raising its crest as it hunts among the leaves for insects. I only found one nest of this bird, whilst watching a nest of *D. cinnamomeus*. It contained two young birds and was pendant, and as far as I could judge, made entirely of moss. I had others brought in by Kachins.

*(234) Herpornis xantholeuca, Hodgs.—(The White-bellied Herpornis).

Fairly plentiful at Simlum, up to 5,000 feet, but I could find no signs of it breeding.

LIOTRICHINÆ.

*(235) Liothrix lutea, (Scop.)—(The Red-bellied Liothrix.)

One specimen at M'ba Kha.

(238) Pteruthius æralatus, Tick.—(Tickell's Shrike-Tit.)

Recorded by Col. Rippon.

*(239) Pteruthius melanotis, Hodgs.—(The Chestnut-throated Shrike-Tit.)

Three specimens.

(243) Ægithina tiphia, (Linn.)—(The Common Iora.)

Common in the plains, and does not ascend the hills.

(246*a*) Chalcoparia phœnicotis, (Temm.)—(The Ruby-cheek.)

Recorded by Col. Rippon.

(247) Chloropsis aurifrons, (Temm.)—(The Gold-fronted Chloropsis.)

Recorded by Salvadori.

(250) Chloropsis chlorocephala, (Wald.)—(The Burmese Chloropsis.)

Recorded by Col. Rippon.

*(257) Mesia argentauris, Hodgs.—(The Silver-eared Mesia.)

Kachin name.—Che-roi-che-rit (from its note).

Very common in the hills, and may be heard continually calling all day. I found a good many nests, the common type being a suspended one made of bamboo leaves lined with roots, others again being built of moss and placed in the fork of a small tree.

*(258) Minla igneitincta, (Hodgs.)—(The Red-tailed Minla.)

One pair procured; no signs of breeding.

BRACHYPODINÆ.

Kachin name for all Bulbuls—Kator.

*(270) Hypsipetes concolor, Blyth.—(The Burmese Black Bulbul.)

Does not ascend the hills to any height.

(272) Hemixus flavala, Hodgs.—(The Brown-eared Bulbul.)

Recorded by Col. Rippon.

*(274*a*) Hemixus holti, (Swinh.)—(Swinhoe's Bulbul.)

Kachin name.—Nyam.

Cat. of Birds, Vol. VI, p. 61.

Differs from *macclellandi* by having back ashy-brown instead of olive-green; wings olive-green contrasting with the back, and forehead light rufous with pale centres to the feathers. All my specimens agree with Col. Rippon's Yunnanese birds and Col. Bingham's birds from the Shan States.

They are very noisy birds, with sharp strident notes, quite different from those of any other bulbuls. I could find no signs of their breeding during my stay at Sinlum.

(275) HEMIXUS MACCLELLANDI, (Horsf.)—(The Rufous-bellied Bulbul.)

Recorded by Col. Rippon.

* (277) ALCURUS STRIATUS, (Blyth.)—(The Striated Green Bulbul.)

Four specimens.

* (279) MOLPASTES BURMANICUS, (Sharpe.)—(The Burmese Red-vented Bulbul.)

Kachin name.—Kator-tor-mung.

This bird must be partially migratory, as when I first went up to Sinlum they were very scarce, but at the beginning of May their numbers were considerably increased. They probably come up to the hills for nesting purposes, and to feed on the wild raspberries which fruit in such profusion about this time. I found several nests in May.

* (287) XANTHIXUS FLAVESCENS, (Blyth.)—(Blyth's Bulbul.)

Kachin name.—Cheng-ma-kator.

The commonest Bulbul above 4,000 feet. Breeds during May and June; and seems to prefer heavier jungle than *P. xanthorrhous.* It builds the usual type of nest and lays 2 eggs, I never found more.

(288) OTOCOMPSA EMERIA, (Linn.)—(The Red-whiskered Bulbul.)

Very common in the plains round Bhamo.

* (292) SPIZIXUS CANIFRONS, Blyth.—(The Finch-billed Bulbul.)

Kachin name.—Kator-sit.

All my specimens have the ear-coverts decidedly grey, and not pale brown. Fairly plentiful in the hills, and breeds during April and May, nesting in the wild raspberry bushes, and seems invariably to use the curled tendrils of creepers largely in the composition of its nest. It lays two eggs. I never found three in one nest.

* (298*a*) PYCNONOTUS XANTHORRHOUS, Anders.—(Anderson's Bulbul.)

Kachin name.—Kator-tor-prong.

Common in the hills round Sinlum, and seems to prefer the more or less open hill-sides, whereas *X. flavescens* keeps to the denser and more matted jungle.

Nesting.—It always seems to build its nest which is of the usual Bulbul type, within two or three feet of the ground, generally placing it in a bramble-bush amongst long grass and weeds; and almost invariably lays three eggs, only on one or two occasions I have taken two incubated eggs. It is impossible to describe the eggs which vary like those of others of the family, they are however always very glossy. Average of 9 eggs ·80 × ·62, the largest being ·83 × ·63, smallest ·78 × ·63.

SITTIDÆ.

(316) SITTA CINNAMOMEIVENTRIS, Blyth.—(The Cinnamon bellied Nuthatch).

Recorded by Oates, Fauna British India.

* (318) SITTA NAGÆNSIS, Godw-Aust.—(Austen's Nuthatch.)

Kachin name.—Pun-che lip.

Plentiful in the hills. I failed, however, to find its nest; but a Kachin at Watan on the 10th April brought me four fresh eggs and the parent bird, which he said he had cut out of the hole of a tree. In the beginning of June 1905, I found a bird building, but had no opportunity of again visiting the hills.

Eggs.—Of the regular family type, white, profusely spotted with red. Measuring ·77 × ·58.

(325) SITTA FRONTALIS, Horsf.—(The Velvet-fronted Blue Nuthatch.)

Recorded by Col. Rippon.

I saw it in the lower valleys.

DICRURIDÆ.

(327) DICRURUS ATER, (Herm.)—(The Black Drongo.)

Common in the plains.

(333) DICRURUS CINERACEUS, (Horsf).—(The Grey Drongo.)

Recorded by Col. Rippon.

(335) CHIBIA HOTTENTOTTA, (Linn.)—(The Hairy-crested Drongo.

Found in the plains. Have not seen it in the hills.

(339) BHRINGA REMIFER, (Temm.)—(Lesser Racket-tailed Drongo.)

Does not ascend above about 4,000 feet, and prefers high tree jungle.

(340) DISSEMURUS PARADISEUS, (Linn.)—(Larger Racket-tailed Drongo.)

Found in the big tree jungle in the plains.

CERTHIIDÆ.

(354) UROCICHLA LONGICAUDATA, (Moore).—(Long-tailed Wren.)

Recorded by Col. Rippon.

* (355*c*.) UROCICHLA KAURIENSIS, Harington.

Ann. and Mag. of N. History, Sept. 1908.

Adult-male.—Very like *U. reptata* (Bingham), but the chest and sides of the breast are of a more rufous-brown, and the middle of breast and belly is distinctly spotted with white.

Total length about 3·7; culmen 0·5; wing 1·8; tail 1·2; tarsus 0·75.

Iris dark red; bill dark horn-colour; legs light brown.

Adult-female.—Similar to the male, but with the wings less rufous and of a more olive-brown.

Hab.—Watan, Bhamo District, Upper Burma.

The abovementioned specimens were a pair and were shot whilst building their nest.

• (355 *d.*) Urocichla sinlumensis, Harington.

Ann. and Mag. of N. History, Sept. 1908.

Adult-male.—Easily distinguishable from *U. reptata* (Bingham) and the above species (*U. kauriensis*) by having the chin and throat mostly white slightly mottled with brownish; the feathers of chest, sides of the breast, and flanks of a more olive colour, conspicuously spotted with white and tipped with black.

Total length about 4·1 : culmen 0·45 ; wing 1·9 ; tail 1·9 ; tarsus 0·75.

Iris reddish-brown ; bill black ; legs brownish.

Hab.—Sinlum-kaba, Bhamo District, Upper Burma.

Fairly plentiful in the dense undergrowth near water, and has a very noticeable loud song, which may often be heard during April and May. I did not procure as many specimens as I might have, as I thought the bird was *U. reptata* and was always in hopes of finding a nest so refrained from shooting.

(357) Pnoepyga pusilla, Hodgs.—(Brown Wren.)

Recorded by Col. Rippon.

SYLVIIDÆ.

* (372) Tribura luteiventris, Hodgs.—(The Brown Bush-Warbler.)

One specimen. I think my bird belongs to this species. It is a very difficult bird to watch and to collect, as it keeps to belts of thick grass and rushes. Has a very grasshopper-like note. I spent days trying to find a nest in a small patch of grass inhabited by two or three pairs of birds. I however found one nest building, putting up both birds from the same tuft of grass, it was loose dome-shaped one made entirely of grass. I had a similar nest and three eggs brought me by a Kachin, the eggs are like those of *T. thoracica* in the Museum, being white and speckled all over with minute red and purple spots.

(373) Tribura mandellii, (Brooks.)—(Mandelli's Bush-Warbler.)

Recorded by Col. Rippon.

(374) Orthotomus sutorius, (Forst.)—(The Indian Tailor-Bird.)

Common round Bhamo, a great number nesting in the Fort ; have seen nests in trees at about 15 feet from the ground.

(382) Franklinia gracilis, (Frankl.)—(Franklin's Wren-Warbler.)

Recorded by Salvadori.

(389) Megalurus palustris, (Horsf.)—(The Striated Marsh-Warbler.)

Common in the rushes outside the Fort.

(404) Herbivocula schwarzi, (Radde.)—(Radde's Bush-Warbler.)

Recorded by Col. Rippon.

(410) Phylloscopus fuscatus, (Blyth.)—(The Dusky Willow-Warbler.)

Recorded by Col. Rippon.

* (410*a*) Phylloscopus armandii, (Milne-Edws.)—(Armando Willow-Warbler.)

Plentiful, my specimens were kindly identified for me by Dr. E. Hartert.

Dressers Palæartic Birds, p. 126.

"Differs from *L. fuscata* in having the bill stouter, the throat and belly greenish-white, and the feet more slender, the first primary 0·7, second equal to, or a trifle shorter than the 8th."

My birds were kindly identified for me by Dr. Hartert.

(417) PHYLLOSCOPUS SUPERCILIOSUS, (Gm.) –(The Crowned Willow-Warbler.)

(423) ACANTHOPNEUSTE PLUMBEITARSUS, (Swinh.)—(Middendorff's Willow-Warbler.)

(425) ACANTHOPNEUSTE TENELLIPES, (Swinh.)—(The Pale-legged Willow-Warbler.)

(426) ACANTHOPNEUSTE LUGUBRIS, (Blyth.)—(The Dull-green Warbler.)

The above all recorded by Col. Rippon.

I was too late in the season for the migratory birds and have since my return collected a fair number, which I hope to send home for identification·

* (429) ACANTHOPNEUSTE TROCHILOIDES, (Sundev.)—(Blyth's Crowned Willow-Warbler.)

Common in the hills, but no signs of breeding.

* (430) ACANTHOPNEUSTE DAVISONI, Oates.—(The White-tailed Willow-Warbler.)

Very plentiful in the hills. I found three nests in April, securing the parent birds.

It builds a large dome-shaped nest placed on the ground, of grass lined with moss and vegetable down, and lays three to four pure white eggs, measuring ·55 × ·45.

* (432) CRYPTOLOPHA TEPHROCEPHALA, (Anders.)—(Anderson's Fly-catcher Warbler.)

Fairly plentiful in the hills.

I think they must be late breeders, as I was quite unsuccessful in finding any signs of their nesting, but on my last day at Sinlum an old Kachin brought me in a nest with four eggs and the parent bird; the nest was a large massive globular structure of grass and roots, lined entirely with moss, and was said to have been placed in a bush about two feet from the ground.

Eggs.—Are a pure white and measure ·65 × ·48.

* (437.) CRYPTOLOPHA CASTANEICEPS, (Hodgs.)—(The Chestnut-headed Flycatcher Warbler).

One specimen.

* (440) ABRORNIS SUPERCILIARIES, Tick.—(The Yellow-bellied Flycatcher Warbler).

One specimen.

* (446*a*) HOREITES FLAVOLIVACEA INTRICATUS, (Hartert.)

Two specimens which were identified for me by Dr. Hartert.—The description of this bird is to come out in Dr. Hartert's work on Palæartic Birds.

* (454) PHYLLERGATES CORONATUS, (Jerd. and Blyth)—(The Golden-headed Warbler.)

Five specimens.

* (461) SUYA SUPERCILIARIS, Anders.—(Anderson's Hill Warbler.)

Very common in the hills. Found several nests. All were cylindrical in shape, with a wide entrance near the top, made of woven grass with a little moss in the foundations; very unlike the nests of this species I found at Thandoung (Toungoo Dist.), which were untidy dome-shaped structures made of grass and very like a small *Munia's* nest; the eggs are, however, the same. I have a fine series of these eggs, running from a pale pinky white with red spots forming a zone, down to a pale blue-green with bold rusty red spots, in fact, very like small eggs of *S. khasiana.* Average of 14 eggs is ·65 × ·51, the largest being ·68 × ·50 and the smallest ·63 × ·50.

(463) Prinia flaviventris, (Deless.)—(The Yellow-bellied Wren-Warbler).

Very common in the plains near the river.

(466) Prinia inornata, Sykes.—(The Indian Wren-Warbler.)

Recorded by Col. Rippon.

LANIINÆ.

(474) Lanius collurioides, Less.—(The Burmese Shrike.)

Recorded by Salvadori.

I did not meet with this specimen, which is so common in the Southern Shan States. But since my return find it fairly plentiful round Bhamo during the cold weather.

(475) Lanius nigriceps, (Frankl.)—(The Black-headed Shrike.)

Well distributed in the Hills. I found two or three nests at Sinlum, one containing six eggs.

*(481) Lanius cristatus, Linn.—(The Brown Shrike.)

About the 7th May several birds appeared on migration at Sinlum. Whether they breed there or not I cannot say.

(484) Hemipus picatus, (Sykes.)—(The Black-backed Pied-Shrike.)

Recorded by Col. Rippon.

*(485) Hemipus capitalis, (McClell.)—(The Brown-backed Pied-Shrike.)

One specimen.

(488) Tephrodornis pondicerianus, (Gmel.)—(The Common Wood-Shrike.)

Recorded by Col. Rippon.

*(490) Pericrocotus speciosus, (Lath.)—(The Indian Scarlet Minivet.)

*(495) Pericrocotus brevirostris, (Vig.)—(The Short-billed Minivet.)

(496) Pericrocotus neglectus, Hume.—(Hume's Minivet.)

Recorded by Col. Rippon.

*(498) Pericrocotus solaris, Blyth.—(The Yellow-throated Minivet.)

I was not successful in getting the eggs of any minivets, only finding nests with young.

(506) Campophaga melanoptera, (Ripp.)—(Pale Grey Cuckoo Shrike.) Recorded by Col. Rippon.

(510) Graucalus macii, Less.—(The large Cuckoo Shrike.) Have since procured specimens.

(512) Atarmus fuscus—Vieill.—(Ashy Grey Swallow Shrike.) Saw several in old hill cultivations (toungyas).

ORIOLIDÆ.

(521) Oriolus melanocephalus, Linn.—(The Indian Black-headed Oriole.)

Recorded by Col. Rippon.

* (522) Oriolus trailii (Vig.)—(The Maroon Oriole.) Met with in the hills.

EULABETIDÆ.

(524) Eulabes intermedia (Hay.)—(The Indian Grackle. Recorded by Salvadori.

STURNIDÆ.

(535) Spodiopsar cineraceus, (Temm.)—(The Grey Starling.) Recorded by Oates in "The Fauna of British India."

The only time I have seen this bird was one specimen I procured at Kamaing, Myitkyina Dist. Since my return from leave, I saw two grey starlings on the polo ground when returning from parade.

(538) Sturnia malabarica, (Gm.)—(The Grey-headed Myna.) Recorded by Salvadori.

* (539) Sturnia nemoricola, Jerd.—(The White-winged Myna.) Plentiful in the plains, breeding in any convenient hole in the trees.

* (546) Graculipica nigricollis, (Payk.)—(The Black-necked Myna.) Common round Bhamo and in the Loije Valley. Builds a large untidy nest during May, at the extremity of a bough, like *Sturnopastor superciliaris.*

(547) Graculipica burmanica, (Jerd.)—(Jerdon's Myna.) Common in the plains, building the usual Myna's type of nest, in any convenient hole in tree, wall or building.

(549) Acridotheres tristis, (Linn).—(The Common Myna.) Common: does not ascend the hills.

(553) Æthiopsar grandis, (Moore.)—(The Siamese Myna.)

* (554) Æthiopsar albicinctus, (Godw.-Aust.)—(The Collared Myna.) Both plentiful in the plains, nesting in holes of trees and in buildings; a regular colony of these two and *G. burmanica* nest in the holes in the Bhamo Fort ditch. I once got a spotted egg of *Æ. albicinctus* from a nest in one of these holes.

* (556) Sturnopastor superciliaris, Blyth.—(The Burmese Pied Myna.)

Very common in the plains.

MUSCICAPIDÆ.

*(559) HEMICHELIDON FERRUGINEA, Hodgs.—(The Ferruginous Fly-Catcher.)

Two specimens.

*(560) SIPHIA STROPHIATA, Hodgs.—(The Orange-gorgeted Fly-Catcher.)

One specimen.

(562) SIPHIA ALBICILLA, (Pall.)—(The Eastern Red-breasted Fly-Catcher.)

Recorded by Col. Rippon.

*(569) CYORNIS MELANOLEUCUS, (Hodgs.)—(The Pied Fly-Catcher.)

Fairly plentiful in the hills. I could find no signs of it breeding.

(575) CYORNIS RUBECULOIDES, (Vig.)—(The Blue-throated Fly-Catcher.)

(576) CYORNIS TICKELLI, Blyth.—(Tickell's Blue Fly-Catcher.)

Both recorded by Col. Rippon.

*(575*a*) CYORNIS WHITEI, Harington—

The Ann. and Mag. of N. History. Sept. 1908.

Adult-male.—Most nearly allied to *C. tickelli*, Blyth, but the general colour of the upper parts, including the wings and tail, is more of a turquoise-grey-blue, and the feathers forming the band across the forehead and the superciliary stripes, as well as the last wing-coverts, are pale turquoise-blue; the cheeks and sides of the face are slaty-black, without any trace of the blue wash which is so conspicuous in *C. tickelliæ*.

Total length about 5·2 inches ; culmen 0·45 ; wing 2·8; tail 2·4 ; tarsus 0·7.

Female (?) Two females, presumably of this species, resemble those of *C. rubeculoides* (Vigors). One, however, differs in having the right-hand middle tail-feather pale turquoise-blue, like that of the male ; there can be no doubt that the sex of this bird was correctly ascertained, for it was captured on its nest and, owing to its blue tail-feather, carefully examined.

Total length about 5·1 inches ; culmen 0·45 ; wing 2·7; tail 2·4 ; tarsus 0·65.

Hab.—Male.—Watan, Bhamo District, 3rd April. Female (with blue tail feather)—Sinlum-kaba, Bhamo District, 27th April. Second female—Mongwai, Bhamo District, 12th April.

I propose calling this beautiful bird after Sir Herbert Thirkell White, K.C.I.E., Lieutenant-Governor of Burma.

* (579) STOPAROLA MELANOPS, (Vig.)—(The Verditer Fly-Catcher.)

Kachin name.—Sum-wo-mo.

Very plentiful in the hills during the breeding season. I found several nests in holes along the side of the roads round Sinlum. Some of the eggs were of the pure white type, and four to five seem to be the complement.

(590) ALSEONAX MUTTUI, (Layard.)—(Layard's Fly-Catcher.)

Recorded by Col. Rippon.

*(592) CULICICAPA CEYLONENSIS, (Swains.)—(The Grey-headed Fly-Catcher.)

Common; one nest, two eggs in May.

* (595) NILTAVA MACGRIGORIÆ, (Burton.)—(The Small Niltava.)

I found one nest in a valley below Sinlum on the 25th April, securing the hen bird ; the nest was placed in a hole in a rock, and composed almost entirely of moss, lined with a few fine roots, and measured 2″ × 1½″ inside.

Eggs.—Are very like miniature robin's eggs, having a pinkish ground colour and profusely spotted with pinkish red spots, and measure ·69 × ·55.

* (599) TERPSIPHONE AFFINIS, (Hay.)—(The Burmese Paradise Fly-Catcher.)

Probably plentiful in the lower valleys. I procured one immature female specimen at Sinlum.

(601) HYPOTHYMIS AZUREA, (Bodd.)—(The Indian Black-necked Fly-Catcher.)

Seen near Bhamo.

*(603) CHELIDORHYNX HYPOXANTHUM, (Blyth.)—(The Yellow-billed Fly-Catcher.)

One of the nicest and most interesting little birds to watch, as it is continually on the move and quite fearless, the cock-bird dancing round with outstretched wings and tail while he sings his little song within a few feet of one's head.

Nesting.—I found two nests, each containing three eggs, both procured by watching, the hen-bird gets very anxious and excited if anyone goes near, and being quite fearless, returns to her nest, so giving it away. The first nest, found on the 16th April, was within five feet off the ground, placed on a small branch of a sapling ; the other, on the 20th, was about 15 feet from the ground at the end of a branch, and very difficult to get at, only being reached by building up a platform from below. The nests are cone-shaped and the prettiest I have ever seen, being placed on the top of a bough, and composed of fine moss covered with lichen attached by cobwebs, and lined with a few red hair-like fibres, and measured 2¼″ × 3″ deep outside and 1¼″ × 1″ deep inside, and were in each case placed under a bunch of leaves and would have been very difficult to find unless the bird was actually seen going to it. I watched many other birds, but from their behaviour did not think the hen had begun sitting.

The cock-bird seems to be more highly coloured than the hen, and can be easily recognized.

Eggs.—When blown are a pure dead white without any gloss, and have round the larger end a small zone of pinkish purple, the average of the six eggs ·56 × ·40, the largest being ·60 × ·40, the smallest ·55 × ·40.

* (605) RHIPIDURA ALBICOLLIS, (Vieill.)—(The White-throated Fantail Fly-Catcher.)

Does not go up the hills to any height.

(To be continued.)

ON SOME UNDESCRIBED BEES AND WASPS CAPTURED BY LIEUT.-COL. C. G. NURSE IN INDIA.

BY P. CAMERON.

ANTHOPHILA.

Halictus simlaensis, sp. nov.

Black; the head and thorax thickly covered with white pubescence and closely punctured; the area on the median segment at the base is irregularly striated; the striæ straight in the middle, oblique at the sides; abdomen long and slender, smooth, shining impunctate, the segments not depressed nor constricted; legs black, the calcaria white, the apex of the clypeus broadly yellow. ♂

Length, 7-8 mm.

Hab.—Simla.

Antennæ if anything, longer than the abdomen, black; the flagellum in part brownish beneath and the joints are slightly dilated below. The labrum and clypeus are covered thickly with white pubescence; the apex of the clypeus is broadly lemon-yellow; the eyes are long and distinctly converge below; the hinder ocelli are separated from each other by a much greater distance than they are from the eyes. Thorax closely punctured; there is a narrow longitudinal furrow on the sides of the mesonotum. The striæ on the median segment are irregular, especially those in the middle. Legs black, the apices of the tarsi pale, the calcaria white, the forelegs are piceous in front, they are thickly covered with white hair, which is thickest on the tarsi. Abdomen long; the basal 3 segments together are as long as the head and thorax united, it is smooth and shining, the basal segments are narrowly brownish at the apex. Wings clear hyaline, the stigma and nervures are dark fuscous; the 3rd cubital cellule at the top is shortly, but distinctly, narrower than the 2nd; tegulæ black, piceous in the middle.

Andrena arima, sp. nov.

Black; the head covered with long white hair, the pro-and mesonotum with the scutellum thickly covered with long bright fulvous hair; the basal segment of the abdomen covered with long white hair, the apices of the 2nd 3rd and 4th segments banded with white pubescence, the apical segments above thickly covered with long, plumose, pale fulvous hair; the legs thickly covered with white hair, the hair on the underside of the metatarsus has a fulvous tinge; the wings clear hyaline, the stigma and nervures are blackish. ♀

Length, 8-9 mm.

Hab.—Simla.

Antennæ entirely black; clypeus shining, covered with longish white hair, the apex widely depressed almost furrowed and broadly rounded. The labrum is obliquely narrowed towards the apex, the apex in the middle is roundly and deeply incised, the incision forming almost a semicircle; it is smooth and shining with the sides and apex fringed with long pale golden hair. Mandibles black, piceous at the apex; their lower side fringed with pale hairs.

Mesonotum opaque, alutaceous and with a shallow furrow down the centre. Scutellum shining, its base almost bare. Median segment opaque, closely and minutely punctured all over, the basal area is not clearly defined, its base is irregularly, longitudinally striated. Abdomen shining, impunctate; the basal segment is broadly and deeply furrowed on the basal half, the ventral segments are fringed with long pale hair, their apices are bordered with clear white hair.

In Bingham's arrangement this species, if anywhere, would come into his section *B*, or, better still, it might form a new one:—the area on the median segment not clearly defined, its base irregularly, longitudinally striated.

Andrena caroli, sp. nov.

Black; the apices of the abdominal segments, narrowly but distinctly, the tibiæ and tarsi rufo-testaceous; the head and thorax thickly covered with long white hair; the wings hyaline, the stigma rufo-testaceous, the nervures darker. ♂

Length, 12-13 mm.

Hab.—Simla.

Head densely covered with long white hair; the sides have the hair darker coloured, as has also the hinder part of the vertex; the front is distinctly, and somewhat strongly, punctured; the sides have the punctures smaller, the vertex is less strongly punctured. The clypeus, except at the apex, is strongly punctured; the labrum is smooth and shining in the middle, where it is triangularly incised, the sides are depressed and are strongly aciculated, almost punctured. Mandibles black, piceous towards the apex: the middle is deeply furrowed. Mesonotum strongly, closely and uniformly punctured; in its centre is a narrow longitudinal furrow. The basal area of the median segment is closely punctured; on the apical slope is a large, deep, smooth pyriform depression. The 1st and 2nd transverse cubital nervures are straight, not angled at the bottom or middle, as is usually the case; the 3rd cellule at the top is slightly longer than the 2nd, the 2nd recurrent nervure is received shortly behind the apical third of the cellule. Legs black; the tibiæ and tarsi have a piceous or testaceous tinge; the apical joint of the tarsi is clear rufo-testaceous; the spurs are pale testaceous. The basal segment of the abdomen is covered with soft white hair; the 2nd to 5th segments have their apices fringed narrowly with white hair, the part behind this is piceous; the 6th segment is brownish.

Comes near to *A. mephistophelica*, Cam. The 2nd cubital cellule is smaller than usual; and noteworthy, is the straight, oblique cubital nervure.

Andrena punjaubensis, sp. nov.

Black; the pubescence cinereous, that on the mesonotum tinged with fulvous, on the last 2 dorsal abdominal segments long and black; wings almost hyaline, the nervures and costa black; the tegulæ piceous. Metanotal area closely finely punctured, narrowly furrowed down the middle. ♀.

Length, 10 mm.

Hab.—Ferozepore—March.

Clypeus somewhat strongly, closely punctured, shining, almost bare in the centre, the apex transverse, depressed, the sides projecting into broad teeth. Labrum almost semicircular, smooth, not furrowed, the apex fringed with long golden hair. Pro-and mesothorax closely punctured, the latter more strongly than the former, the latter with a narrow smooth furrow down the middle of basal half. Metanotal area not very clearly separated, the rest of the metanotum more strongly punctured, the punctures round and clearly separated. Abdomen closely, minutely punctured, the pygidium bare, aciculated, the apex bluntly rounded. The 2nd abscissa of the radius is not much longer than the 3rd; the 1st recurrent nervure is received in the middle of the cellule. The hair on the hind tibiæ and tarsi is tinged with fulvous.

There is a furrow on the apical slope of the metanotum; it is wide, becomes wider towards the apex and is moderately deep.

Belongs to Bingham's Section A. *a*. It may be known from the two species included in it by the absence of red or yellow from the abdomen.

Andrena ferozeporensis, sp. nov.

Black; the apices of the 4 anterior tarsi, the whole of the posterior and the posterior tibiæ rufo-testaceous; the antennæ from the 3rd joint, except on top, dark rufous. Wings clear hyaline, the costa and stigma dark testaceous, the nervures blackish; the 2nd abscissa of radius about one-fourth longer than the 3rd, the 1st recurrent nervure is received at the base of the apical 3rd of the cellule. Metanotal area closely, finely punctured. Pygidium broadly roundly raised in the centre, narrowed towards the apex, which is reddish; the sides are flat. Pubescence long and white, the apices of the abdominal segments testaceous and covered with white pubescence; the back of the abdomen has a slight violaceous tinge. ♂

Length, 10 mm.

Hab.—Ferozepore—March.

Clypeus shining, distinctly punctured, more closely above than below and sparsely striated there. Labrum opaque, fringed on the sides and apex with golden pubescence, the centre with rounded tubercles. Front and vertex opaque, alutaceous. Mesonotum with a narrow furrow on the basal half; the scutellum is more strongly and distinctly punctured than it. There is no furrow on the apical slope of the metanotum. Apical abdominal segments finely, closely punctured.

Belongs to Bingham's section A. *b*., near *A. mephistophelica*, Cam.

Megachile striolata, sp. nov.

Black; the pubescence white; the metanotal area distinctly bordered by a keel round the apex, stoutly, closely, regularly striated; mandibles bidentate, the apical tooth longer and more sharply pointed than the other; the space behind them straight, slightly oblique, not dilated; wings clear hyaline, the nervures and stigma black, the 1st abscissa of radius about one-fourth shorter than the 2nd; the 1st recurrent nervure widely distinct from it—about two-thirds of its length; the 2nd touching the 2nd transverse cubital. ♀.

Length, 5 mm.

Hab.—Simla—September.

Puncturation close, distinct. Head a little wider than the thorax ; the clypeus roundly convex, its apex transverse : occiput transverse. Basal slope of abdomen surrounded by a keel, the apices of the segments with narrow bands of white pubescence on all of them, including the last ; the scopa white, very slightly tinged with fulvous. The central part of the metanotum is very smooth, bare and shining.

Comes close to *M. parvula*, Cam, (Willanchr. Mem. xli, No. 4, 1897, p. 135) which may be known from it by the apex of the mandibles being rufous, with the teeth much broader, less clearly separated, by the metanotal area having the striæ much stronger and more widely separated, more depressed and without a stout apical bordering keel ; the keel bordering the base of the abdomen is stouter and much more distinct and the 1st recurrent nervure is nearer the transverse cubital. The other little species, *e. g.* *M. cathena*, *M. punjabensis* and *M. amonyma* have not the metanotal area striated.

Megachile heterotricha, sp. nov.

Black ; the hair on the head, thorax and basal 2 segments of abdomen fulvous, that on the metanotum and base of abdomen paler, the hair on the vertex mixed with black, the neutral scopa fulvous, black laterally on the basal 2 segments, black entirely on the others ; the hair on the legs pale fulvous, on the underside of the middle tarsi rufous, on the hinder tarsi black. Wings hyaline, their apex slightly infuscated, the nervures black. ♀.

Length, 13 mm.

Hab.—Simla—August.

Face closely strongly, the clypeus more strongly, but not so closely, punctured, the apex of the latter smooth, depressed in the middle and not quite transverse; being shallowly incised. Mandibles bidentate, the apical tooth longish triangular, the subapical shorter, broadly rounded ; it is followed by a broad rounded swelling, with a small depression in the centre at the apex ; the puncturation is close at the base below, more scattered elsewhere. Abdomen closely punctured, the puncturation becoming closer and stronger towards the apex ; the last segment large, depressed towards the apex and with a short longitudinal keel before the depression ; there are no distinct transverse furrows. Base of metatarsus nearly as wide as the apex of tibiæ. The 1st abscissa of radius a little shorter than the 2nd.

The ♂ has the fore coxæ unarmed, the apical abdominal segment is broadly bilobate.

In Bingham's system this species would come near *M. bhavanæ*, a much larger species (20 mm.)

Megachile semireticulata, sp, nov.

Black ; the surface of the front, face and clypeus hidden by long white pubescence, the white pubescence on the thorax is as long but not so dense, the basal 5 abdominal segments with a band of white depressed pubescence on their apices, the basal segment having also longish white hair, the hair on the ventral surface long, white, moderately dense. Legs with white pubescence the apical tarsal joint pale rufous, the spurs pale, the fore coxæ with stout teeth. Wings hyaline, the costa and nervures fuscous. Apical abdominal segment with 9 teeth, the central is broad, almost square, with the apex more or less incised, the others longish, sharp-pointed, the outer shorter and blunter than the others. Flagellum brownish. ♂

Length, 10 mm.

Hab.—Ferozepore, Punjab.

Front and vertex closely, somewhat strongly, punctured ; the sculpture and form of the clypeus is hidden by the dense hair Mesonotum closely punctured, the punctures round, forming almost reticulations. Metanotal area almost smooth. Abdominal segments finely, closely punctured, the last more strongly than the others, its ventral armature in the form of 3 stout teeth, of which the central is longer and narrower, the lateral broad at the base, becoming gradually narrowed to a fine point, the outer sides rounded. There are 2 large wide mandibular teeth, rounded at the apex, the apical is much longer than the others.

Allied apparently to *M. albibrous*, Sm., but the form of the abdominal segments has not been described.

Megachile ferozeporensis, sp. nov.

Black; the coxæ, femora and basal slope of abdomen piceous ; the pubescence on the head, thorax, apex of dorsal abdominal segments and base of scopa clear white, the apical half of the scopa white mixed with bright red ; wings clear hyaline, the tegulæ and costa piceous, the nervures black. Apex of mandibles rufous, with 2 large teeth, the 2nd triangular and shorter than the apical which is broadly rounded at the apex.

Length, 7 mm. ♀, ♂ almost 6 mm.

Hab.—Ferozepore, Punjab—April.

Clypeus closely, somewhat strongly, punctured, the centre of the face smooth, shining. Thorax closely, distinctly punctured, the metanotal area finely aciculated, the rest of the metanotum less closely punctured than the mesonotum. Abdomen less strongly punctured than the thorax, the puncturation becoming weaker towards the apex. Beyond the extreme base the metatarsus is not much narrower than the apex of tibiæ.

The ♂ is smaller, has the antennæ longer (as long as the head and thorax united), the apical abdominal segment ends in 4 irregular teeth, of which the central 2 are longer and sharper, the space behind them being depressed.

Megachile simlaensis, sp. nov.

Black ; the pubescence on the head, thorax, and base of abdomen white, the apices of the 2nd and following dorsal abdominal segments with narrow white hair bands, the rest of them covered with black hair, which is longest on the apical segments ; the pollen-brush bright red, paler on the basal segment ; the hair on the legs white, reddish on the innerside of the hind tarsi; fore calcaria pale, the hinder testaceous ; wings hyaline, the apex slightly violaceous ; the nervures black. Mandibles with a longish triangular apical and 2 longish bluntly rounded teeth. ♀.

Length, 14 mm.

Hab.—Simla—May.

Head as wide as the thorax, above closely, distinctly punctured; the face sparsely punctured in the centre, closely laterally, the clypeus somewhat strongly punctured, with an irregular smooth line down the middle, the depressed apex being also smooth, its centre projecting somewhat. Mandibles, except at the apex, covered with longish punctures, which run into each other. The thorax closely, distinctly punctured, the metanotum less strongly than the rest, its area smooth, opaque. Abdomen closely, finely punctured, without distinct transverse depressions. Base of hind metatarsus nearly as wide as the apex of tibiæ; the apex of 5th tarsal joint narrowly and the claws rufous.

The pygidium is large, is more closely and distinctly punctured than the other segments, is turned up at the apex and has no median impressed line. The apices of the 2nd and 3rd abdominal segments are broadly, not deeply, depressed. The femora are castaneous brown below. The sides of the 2nd and following abdominal segments are fringed, next to the pollen brush, with long black hair. Occiput slightly, broadly, roundly emarginate. Allied to *M. conjuncta*, Sm.

Megachile melanoneura, sp. nov.

Black; the pubescence on the head, mesonotum, upper part of mesopleuræ and base of abdomen, pale fulvous, on the rest of the body, including the ventral surface, it is much paler, almost white, except on the outer edges of the ventral surface, the last segment above and below and on the apices of the 2nd to 4th, where it is black; the pubescence on the legs pale fulvous, reddish on the underside of the metatarsi. Wings hyaline, the nervures black. ♀

Length, 16-17 mm.

Hab.—Simla—May and August.

Mandibles with 3 short, broad blunt teeth, the apical longer and more sharply pointed than the others and a shorter bluntly rounded inner one. Front closely, the vertex more strongly and more widely punctured. Pro-and meso-thorax closely punctured, the post-scutellum and metanotal area almost smooth, the rest of the latter weakly punctured. The head is as wide as the thorax in the ♀, in the ♂, a little wider than it. Abdomen closely, not very strongly punctured; in the centre of the 2nd segment is a deep, slightly curved furrow and there is a more indistinct one on the third. Shortly beyond the base the hinder metatarsus is as wide as the apex of tibiæ; the calcaria pale fulvous.

What Col. Nurse regards as the ♂ of this species has the anterior tarsi greatly dilated, white, the outer edge with a long, dense hair fringe, the inner side at the base with a much shorter hair fringe, which is white above, white on the inner, black on the lowerside below; the fore tibiæ are much dilated, white, streaked with brown below; the teeth on the fore coxæ are about four times longer than wide, of equal width rounded at the apex. The hair all over is long and dense; on the back of the abdomen it is pale fulvous, below it is white. The last abdominal segment in the centre, is widely and deeply depressed, and is closely rugosely punctured, there is in its centre, a slight shallow curved border, with a short, blunt tooth on either side, outside it are two longer, more sharply pointed teeth. The last ventral segment is also widely and deeply depressed in the middle; the apex of the penultimate is raised, almost trilobate in the centre, this part being bordered by a stout tooth.

In Bingham's table this species comes near *M. penetrata*, Sm.; in that species the vertex, mesonotum and scutellum are bare of pubescence; Smith calls the nervures ferruginous, while in the present species they are black; Bingham described the wings as "light flavo-hyaline", in my species they are hyaline, slightly clouded at the apex; the latter author calls the pollen-brush "bright fulvous."

Megachile inepta, sp. nov.

Black; the pubescence on the front, vertex, mesonotum and base of abdomen pale fulvous; the abdominal segments with narrow bands of bright reddish fulvous pubescence on their apices, the pubescence on the face, clypeus, sides and back of head, pleuræ sternum and on the basal 3 ventral segments, white, on the apical ventral segments, the white is distinctly tinged with fulvous; wings hyaline, the nervures black. Mandibles bluntly bidentate, the part behind the teeth broadly, roundly dilated; the puncturation strong, the base covered with a dense silvery pile. The pubescence on the legs white, on the underside of the hinder metatarsus fulvous; the base of the hind metatarsus about one-third narrower than the apex of the tibiæ.

Length, 13 mm.

Hab.—Simla—September.

Head as wide as the thorax. Face and clypeus strongly punctured, the apex of the face with a smooth line, from the centre of which another smooth line runs half way down the centre of the clypeus, the apex of which is rough and transverse. Metanotal area coarsely aciculated. First abscissa of radius not quite one-fourth shorter than the second.

This species is not unlike *M. subfusca*, Cam., of which I only know the ♂, I do not consider them to be sexes of one species, *e. g. subfusca* has the stigma testaceous, the basal abscissa of the radius is shorter compared with the 2nd, the wings are not clear hyaline, but distinctly infuscated towards the apex, the apical mandibular tooth is much longer compared with the subapical and the puncturation on the basal abdominal segments is not nearly so strong.

Megachile punjaubensis, sp. nov.

Black; the pubescence clear white, the dorsal abdominal segments with narrow apical bands of clear white pubescence, the scopa white, the apical half mixed with red; wings clear hyaline, the costa and stigma piceous, the nervures black. Mandibles tridentate, the apical blunter, larger, more rounded than the others, which are triangular. Flagellum for the greater part piceous.

Length, 5 mm.

Hab.—Ferozepore—March and April.

The puncturation on the clypeus is less close than it is on the front and vertex ; there is a narrow smooth band on its apex. Puncturation on the thorax close, distinct, on the pleura almost running into reticulations. Base of hind metatarsus hardly half the width of apex of tibiæ ; the spurs and tarsal spines are white ; the apical 2 tarsal joints and the claws reddish.

The ♂ has the antennæ as long as the head and thorax united ; its apical segment is densely covered with white pubescence, in the centre are 2 stout teeth separated by a semicircle, on either side of these are 2 short teeth, with a blunt tubercle beyond them ; the fore coxæ are armed with stout, bluntly pointed teeth.

DIPLOPTERA.

Odynerus rufo-bimaculatus, sp. nov.

Black ; a broad, curved mark on the sides of the upper two-thirds of the clypeus, a dagger shaped mark over the antennæ, its lower part distinctly narrowed, underside of antennal scape, a line on the upper half of outer orbits, an almost interrupted line on the pronotum, roundly narrowed on the sides behind, an irregular mark below the tegulæ, the base and apex of the latter, a longish line rounded on the innerside, on the sides of the scutellum, a squarish one on the sides of post-scutellum, a narrow line on the sides of the 1st abdominal segment, a wider, trilobate one on the 2nd, a short, bilobate one on the centre of the 3rd and 4th and a shorter, wider curved one on the 5th and the apex of the 2nd ventral, pale yellow. Wings clear hyaline, the stigma brown, the nervures blackish ; the apex of the clypeus and 2 large spots near the centre of the 1st abdominal segment rufous, legs red, the middle coxæ below, the 4 anterior tibiæ below and the tarsi pale yellow.

Length, 7 mm.

Hab.—" India ". In my collection.

Clypeus slightly longer than wide, the lower two-thirds of the centre keeled on either side, the apex clearly separated, transverse. Underside of flagellum light orange-brown. Head and thorax closely, not very strongly, punctured. Base of thorax almost transverse, the sides not projecting ; apex of post-scutellum smooth, gradually narrowed to a blunt point, sides of metanotum broadly rounded.

Allied to *O. humbertianus*, Sauss, which has the 2nd abdominal segment tuberculate near the base in the centre and laterally at the apex with a smaller tubercle. In the present species the depression on the metanotum becomes gradually wider towards the apex ; the apical teeth on the metanotum are large, triangular, as wide at the base as they are long. The puncturation on the clypeus runs into striæ at the apex. The frontal mark varies in form, and the reddish marks on the base of the abdomen vary also in size and form.

Odynerus (*Ancistrocerus*) *fooriscutis*, sp. nov.

Black; the clypeus, mandibles, except the upper and lower edges, and the apex, a line on base of pronotum, sometimes 2 marks on post-scutellum, and lines on the apices of the basal 5 abdominal segments above and below, bright lemon-yellow; the apices of the 4 anterior femora broadly, of the posterior more narrowly and the tibiæ and tarsi of a paler yellow; underside antennal scape yellow, of the apical 3 or 4 joints and the hook reddish-brown. Wings iridescent, fuscous, the apex distinctly violaceous, the nervures black. Basal abdominal segment with a stout transverse keel. ♂.

Total length, 9 mm.

Hab. Simla—August.

Clypeus longer than broad, roundly convex, sparsely, strongly punctured, its apex with a rounded shallow incision; sparsely covered with long, pale pubescence front and vertex closely, strongly, punctured, thickly covered with long brownish pubescence. Base of thorax almost transverse, the outer edges forming blunt, rounded teeth; apex of mesonotum depressed. Apex of scutellum with an oval fovea, or depression in its centre; post scutellum more rugosely punctured than the scutellum, its apex in the middle roundly projecting. There is a wide punctured furrow below the tegulæ; from its apex an oblique one, not quite so distinct, runs to the base of the pleuræ. The sides of the metanotum are bluntly rounded, and the base at the sides is reticulated at the apex. The keel on the 1st abdominal segment is crenulated at the apex; the 2nd segment is as wide as long, its sides are rounded.

The antennal hook reaches to the apex of the joint; it is stout and curved Tegulæ dark yellow, fuscous in the centre.

Belongs to Bingham's Section A.; it cannot be confounded with any of the described species of the group.

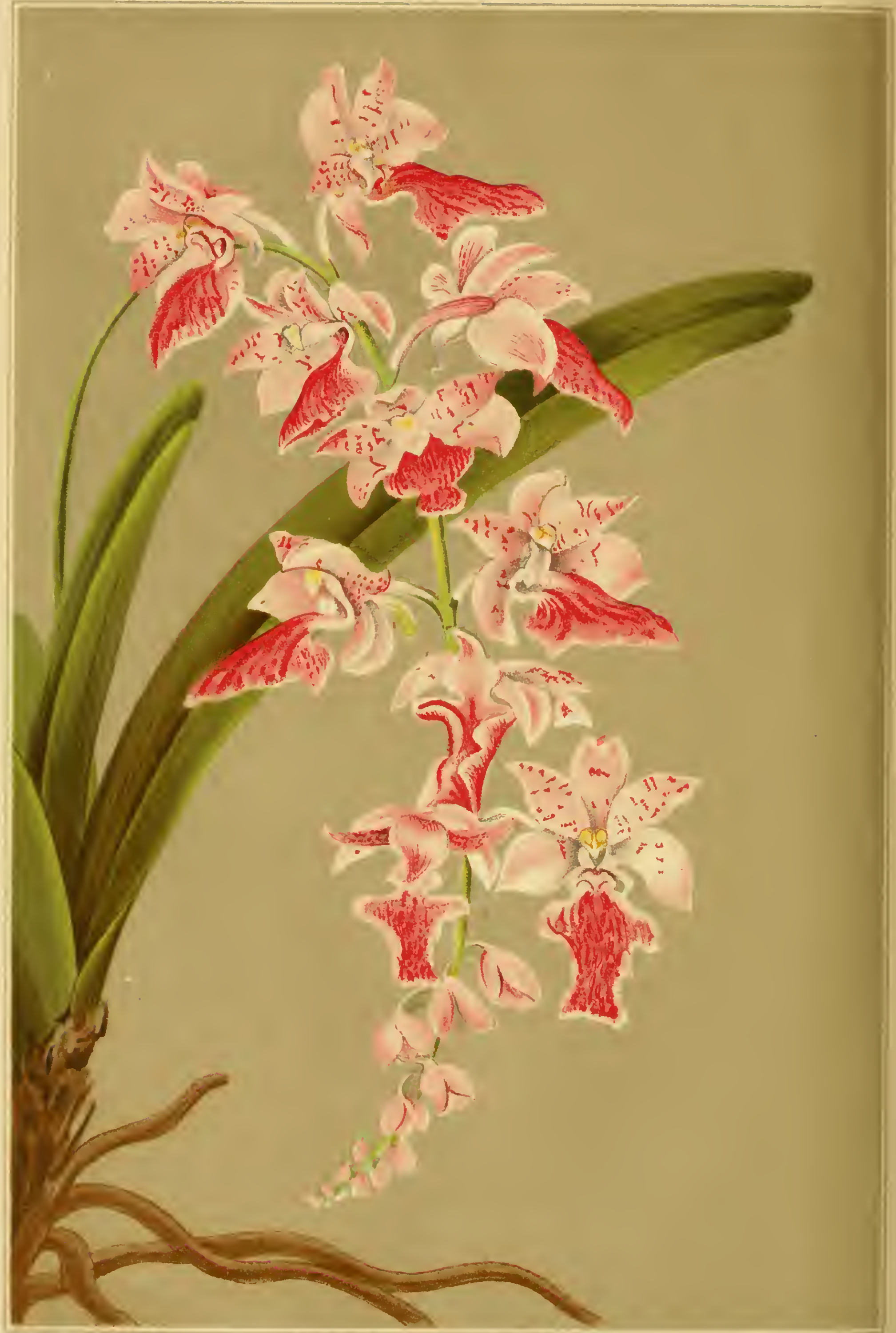
Odynerus ornaticaudis, sp. nov.

Black, the clypeus, except for a large black mark in its centre, rounded above, gradually narrowed below, placed nearer the bottom than the top, a spot, slightly longer than wide, on the front, the eye incision entirely, base of mandibles, a line on the upper half of outer orbits, a large triangular mark on the basal half of the pronotum, a conical mark under and in front of the tegulæ, a conical mark on the sides of the scutellum, the greater part of the post-scutellum, the mark incised in the middle at the base, the sides of metanotum broadly, a line, roundly dilated at the base, on the apex of 1st abdominal segment, a large, oblique, pyriform spot on the sides of the basal half of the 2nd, the narrowed end at the apex, a trilobate line on its apex, a longish spot on the apex of the 3rd laterally, a trilobate band on the 4th, a large oval spot in the centre of the 6th and lines on the apices of the 2nd and 3rd ventral, both widely roundly dilated in the middle, yellow. Four front legs yellow, the 4 anterior coxæ and a line on the femora and tibiæ behind black, the hind coxæ, femora and apex of tibiæ black, the rest yellow. Wings hyaline, the apical half of the radial cellule fuscous violaceous, the nervures and stigma black, tegulæ yellow, with a fuscous spot before the middle. ♀.

Total length 8 mm.

Hab.—" Bombay".

Clypeus as wide as long, its apex wide, almost transverse, the puncturation strong, but not close ; the puncturation on the front and vertex closer but not quite so strong. Base of thorax closer, the sides rounded. Pro- and mesothorax strongly, closely punctured, the post-scutellum less closely and less strongly punctured, its apex bluntly rounded. Metanotum short, almost vertical, the centre depressed. The 1st abdominal segment narrow at the base, becoming gradually widened towards the apex ; the 2nd is clearly longer than it is wide at the apex, its basal half smooth, the apical not very strongly punctured ; the apex of the 3rd is also punctured. Allied to *O. bipustulatus*. Sauss.



Mrs E Silcock, del. J. Green, Chromo.

ÆRIDES CRISPUM, Lindl.

(Life size).

THE ORCHIDS OF THE BOMBAY PRESIDENCY.

BY

G. A. GAMMIE, F.L.S.

PART VIII. (WITH PLATE VIII.)

(*Continued from page* 834 *of Volume XVIII.*)

19. ÆRIDES.

Epiphytes with two-ranked, fleshy, strap-shaped leaves. *Flowers* showy, pink or purple, in dense or loose racemes which are often branched in luxuriant examples, *bracts* minute, *sepals* spreading, the lateral adhering to the base or foot of the column, *petals* similar to sepals, *lip* spurred, three-lobed, *lateral lobes* small, *midlobe* large, *column* short, *foot* short, *anther* 2-celled, *pollinia* 2, globose, furrowed, *strap* long or short, *gland* various.

* *Lip* horizontal.

Stems long. *Flowers* fragrant, *midlobe of lip* ovate. 1. Ærides crispum.

Stems short. *Flowers* not fragrant, *midlobe of lip* oblong. 2. Ærides maculosum.

** *Lip* pendulous.

Stems short. *Leaves* usually mottled. *Midlobe of lip* ovate. 3. Ærides radicosum.

1. ÆRIDES CRISPUM, *Lindl. Fl. Br. Ind. VI, p. 45 ; Cooke, Fl. of Bombay, II, p. 700 ; Dalz. and Gibs., p. 265 ;* Æ. Lindleyana, *Wight. Dalz. and Gibs., p. 265.*

Roots flattened, far spreading, clinging closely to the bark of trees *Stems* stout, often attaining a length of 12 inches, the lower part invested with the sheaths of decayed leaves. *Leaves* 4 to 8 inches long, strap-shaped, unequally 2-lobed at the apex. *Flowers* 1½ inches in diameter, sweetly scented, in simple or branched racemes which are often a foot in length, *peduncle* half the length of the inflorescence, stout, green ; *pedicels* robust, about 1 inch long, *bracts* small, ovate acute, *sepals* white, tinted and streaked with pink, *dorsal* obovate obtuse apiculate, ¾ inch long, *lateral* obliquely ovate oblong acute, *petals* white, tinted and streaked with pink, a little narrower and shorter than the lateral sepals, *lip* 1½ inch long, inflexed at the base, *lateral lobes* short, rounded, standing erect on each side of the column, white, with irregular brown streaks, *midlobe* 1 inch long, ovate oblong, rose-purple, three lobed, base pressed against the column and bearing two large white blotches, *margins* crisped, strongly recurved, except at the base, *spur* short, thick, blunt, green, incurved.

Flowers appear in May and June.

Distribution. Throughout the heavy rainfall zone of the Western Ghats and Konkan extending southwards to Travancore.

This is in many ways the finest of the Bombay orchids and is, perhaps, the one most commonly met with in cultivation. In the dry climate of the Deccan it will thrive and flower for years on tree trunks fully exposed to the scorching sun and wind.

Plate VIII shows a small plant in flower.

2. ÆRIDES MACULOSUM, *Lindl. Fl. Br. Ind. VI, p. 45; Cooke, Fl. of Bombay, II, p. 699; Dalz. and Gibs., p. 266.*

Stems short, stout, clothed below with the brown sheaths of fallen leaves. *Leaves* 6 to 9 inches long, strap-shaped, channelled, apex unequally two-lobed. *Flowers* about one inch in diameter, in drooping simple or branched racemes; *sepals* and *petals* spreading, white, deeply suffused with rose-purple and with darker purple spots and streaks *lateral sepals* about ½ inch long, obovate, *dorsal* narrower, *petals* a little shorter and narrower than the lateral sepals, *lip* three-lobed, ½ inch long, standing out at right angles to the sepals and petals, *spur* short, greenish at the tip which is curved into a hook, base of lip with a fleshy two-lobed, white callus; from each lobe of this a purple line runs downwards into the spur, *lateral lobes* pure white, very short, rounded, *midlobe* large, oblong, rounded, retuse, bright purple all over, the colour forming distinct lines at the base, *margins* crenulate and crisped.

The above is the common variety. There are at least two others which differ as follows :—

Var. b. Sepals and *petals* almost white with only a few scattered purple dots, ground colour of lip white, irrorated and banded with rose-purple.

Var. c. Inflorescence usually branched, *sepals* and *petals* larger and broader, white, deeply suffused with purple upwards, spots and streaks few, *midlobe* of *lip* dark purple down the centre, the colour fading towards the margins.

Flowers appear in May and June.

Distribution. Throughout the heavy rainfall tracts of the Western Ghats and Western Peninsula generally. It wanders further out into the Deccan than any of its congeners and its habit of thickly covering the branches of even low trees makes it a conspicuously beautiful plant at its flowering period which begins with the first onset of the south-west monsoon.

3. ÆRIDES RADICOSUM, *A. Rich. Fl. Br. Ind. VI, p. 46 ; Cooke Fl. of Bombay, II, p. 700 ;* Saccolabium rubrum, *Wight. Dalz. and Gibs., p. 264.*

Stems short, stout, covered (as in the other species) with the sheaths of fallen leaves. *Leaves* narrowly strap-shaped, up to 10 inches long, often mottled with purple, *apex* unequally bi-lobed. *Inflorescence* a short raceme or panicle, *flowers* ⅔ inch in diameter, rose coloured, *dorsal sepal* oblong acute, *lateral* larger orbicular gibbous, *petals* similar to dorsal sepal, *lip* pendulous, longer than the sepals, basal part short, *lateral lobes* small, oblong ; a double callus on the disk at the mouth of the spur, white lineolate with purple, *midlobe* ovate, tip rounded, a longitudinal dark purple band in the centre, margins white, *spur* stout, slightly incurved, obtuse, white.

Flowers appear in May and June.

Distribution. Throughout the heavy rainfall zone of the Western Ghats and Peninsula.

A very robust plant, sent to me by Mr. Spooner from Dharwar, had larger and more distinctly mottled leaves, a branched inflorescence a foot long and *flowers* quite one inch in diameter.

(*To be continued.*)

BIRD NOTES FROM MURREE AND THE GALIS.

BY

MAJOR H. A. F. MAGRATH.

The following notes were made during a period of four months' leave, taken in the Murree Hills this year (1908), in which was included a short trip to the Galis in June, and are, with the exception of occasional references to nesting and other habits, merely a record of impressions of notes and songs of some Western Himalayan species concerning which little has hitherto been done in the matter of syllabifying them in print. To some extent they are supplementary to "Notes on the Birds of Thandiani" published in Vol. XVIII, No. 2, of this Journal (page 284). Colonel H. R. Rattray has already very fully dealt with the oology and nidification of the birds of this locality, *vide* Vol. XVI, Nos. 3 and 4, of this Journal, and although a few species are included in these notes which were unnoticed in that paper, it cannot be claimed for them that they add materially to our knowledge in these respects. A brief description, by way of introduction, of the flora and of the distribution of species in the locality may perhaps render them less uninteresting than if this were omitted.

On my arrival in Murree in the latter part of April there was a great "rush" of birds on migration over the hill, and during the next two or three weeks the following migrants were observed, some of them in great numbers, *viz.*, *Phylloscopus tristis* (The Brown willow-Warbler), *Phylloscopus humii* (Hume's Willow-Warbler) (1 shot), *Phylloscopus subvirides* (Brook's Willow-Warbler), *Acanthopneuste nitidus* (The Green Willow-Warbler), *Siphia parva* (The European Red-breasted Flycatcher), *Motacilla melanope* (The Grey Wagtail), *Anthus trivialis* (The Tree Pipit), *Anthus rosaceus* (Hodgson's Pipit) (1 shot), *Cypselus leuconyx* (Blyth's White-rumped Swift) *Palumbus casiotis* (The Eastern Wood-Pigeon) and *Falco subbuteo* (The Hobby). In the vicinity of Tret (3,500 feet) *Motacilla borealis* (The Grey-headed Wagtail), was observed in considerable numbers and individuals were seen up to the middle of May. As regards local breeding species I observed, with some exceptions, notably among the game birds, all the birds one would expect to meet in the locality.

The local distribution of breeding species in Murree is not without interest. Many species, at breeding time, confine themselves either to one or other side of the ridge, the top of which forms the range boundary for the time being. This is, no doubt, explicable by the range of hills on which Murree stands running practically east and west and the consequent difference in the climate and flora of either slope. The slopes facing south, receiving the direct rays of the sun, have naturally, in the dry season, a much higher temperature than those facing North and here the flora is restricted to an open forest consisting of the Blue Pine (*Pinus excelsa*), Hill Oaks (*Quercus ilex* and *dilata*), The Himalayan Dogwood Tree (*Cornus macrophylla*), a few *Pinus longifolia*, Black Poplars (*Populus nigra*), Mulberries (*Morus alba* and *nigra*), Wild Cherry (*Prunus padus*), Apricot (*Prunus persica*), and Pear trees (*Pyrus variolosa*). Scattered throughout this thin forest and over the hillsides down to the cultivation 3,000 feet below is a thick undergrowth of The Dog Rose (*Rosa moschata*), The Himalayan Honeysuckle (*Lonicera quinquelocularis*), Khenti broom (*Indigofera heterantha*), Ilex scrub (*Ilex dipyrena*), and The Himalayan Barberry (*Berberis aristata*). The Travellers' Joy (*Clematis vitalba*) is often found trailing in profusion over the first two of these shrubs. Until the rains break there is practically no running water on this side of the hill.

Crossing to the northern slopes the aspect of the flora changes considerably. Here we are in dense and varied forest two trees of which are not to be found on the southern slopes, namely, The Silver Fir (*Abies Webbiana*), and The Yew (*Taxus baccatta*). Other trees of this forest are Tall Oaks, *Quercus semecarpifolia*, *dilatata* and *ilex*, Ashes (*Fraxinus floribunda*), Horse Chestnuts (*Æsculus indica*), Sycamores (*Acer pictum*), Himalayan Toon trees (*Cedrela serrata*), Wild Cherry trees, Hazels (*Corylus colurna*) and a few Walnut trees (*Juglans regia*), Blue Pines Black Poplars, and Elms (*Ulmus wallichiana*). With the exception of a little Khenti broom, Himalayan Honeysuckle, a few brambles (*Rubus fruticosus*) and (*lasiocarpus*) and the Dog Rose (*Rosa sericea*), the undergrowth on this side consists almost entirely of *Viburnum fœtens* with here and there patches of *Skimmia laureola*. These two shrubs, I may here mention, compose the undergrowth wrongly referred to in "Notes On The Birds of Thandiani" as *Daphne oleioides* and a species of *Strobilanthes*. On this side there is always running water, though most of the streams dried up this year before the rains.

The following birds (breeding species) which occurred commonly on the South side of the ridge did not appear to occur at all, at any rate in the nesting season, on the North. *Machlolophus xanthogenys* (The Yellow-cheeked Tit), *Acrocephalus dumetorum* (Blyth's Reed-Warbler), *Sylvia affinis* (The Indian Lesser White-throated Warbler), *Horornis pallidus* (The Pale Bush Warbler), *Lanius erythronotus* (The Rufous-backed Shrike), *Terpsiphone paradisi* (The Indian Paradise Flycatcher), *Oreicola ferrea* (The Dark-grey Bushchat), (1 pair nested just over the brow of the hill), *Pratincola maura* (The Indian Bush-chat) and *Emberiza stracheyi* (Eastern Meadow-Bunting). Similarly the following species on the North side did not appear to occur on the South. *Lioptila capistrata* (The Black-headed Sibia), *Pteruthius erythropterus* (The Red-winged Shrike Tit), *Niltava sundara* (The Rufous-bellied Niltava), *Culicicapa ceylonensis* (The Grey-headed Flycatcher), *Merula castanea* (The Grey-headed Ouzel), *Gecinus occipitalis* (The Black-naped Green Woodpecker) and *Indicator xanthonotus* (The Yellow-backed Honeyguide). In the Galis where the general trend of the main ridges is North and South and where the hills are higher and more precipitous the flora, except on the spurs, resembles that on the North of the Murree ridge and the distribution of species does not, in consequence, there exhibit the peculiarities it does in Murree.

1. *Corvus corax* (The Raven).

3. *Corvus corone* (The Carrion Crow).—When the rains broke in July "The Raven" and "The Carrion Crow" (adult and young) were occasionally to be seen about the Murree ridge. The caw of the latter is very distinct from that of *C. macrorhynchus,* the common crow of these parts. The Carrion Crow probably breeds in small numbers near Murree.

31. *Parus atriceps* (The Indian Grey Tit).—Apart from the usual tit chatter, the Indian Grey Tit has a note like "Zwink" "Zwink" in the breeding season.

34. *Parus monticola* (The Green-backed Tit).—Pretty notes of The Green-backed Tit heard this year were "Tweentwee" "Tweentwee,' a loud "Pawee" "Pawee" "Pawee" "Pawee" and a note like "Peewŭt" "Peewŭt." This little Tit is very fond of water and bathes regularly morning and evening. It was common both in Murree and the Galis.

42. *Machlolophus xanthogenys* (The Yellow-cheeked Tit).—The handsome Yellow-cheeked Tit was fairly common at Murree below the bungalows on the south side of the ridge. I found one nest in the hollow and broken stem of

a small mulberry tree on the side of the road, the nest hole being open at the top to the sky. A note uttered by this Tit when approaching the nest was a loud "Towit" "Towit." Another and pretty song note heard when the leaves were being searched for food was "Teetweenh twit-tĕĕtwĕĕnh." When going about in small flocks after the breeding season a note of communication like "Tyŭjĭ" "Tyŭjĭ" is used. Sometimes a chatter precisely similar to that of *Parus atricecps* is used. Less gregarious than others of the family this Tit is often seen solitary. I did not observe it in the Galis and do not now think it should have been included in my list of birds of Thandiani.

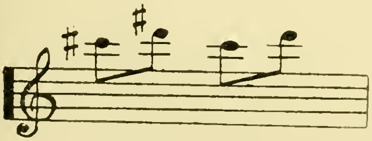
44. *Lophophanes melanolophus*, (The Crested Black Tit).—Another note of The Crested Black Tit is a loud plaintive "Tyü—Tyü" slowly repeated. This little Tit became fairly common in Murree towards the end of June.

204. *Lioptila capistrata* (The Black-headed Sibia).—This bird was rather rare in Murree but at Dunga Gali it was common. In the latter place a nest found in the building was at the top of a young Silver Fir. The note of this Sibia is a single pretty whistle pitched in a high key and repeated 4 or 5 times rapidly. At a distance it sounds like the tinkling of a little silver bell. When hunting for food in the undergrowth the note is a soft rattling chuckle. The flight of these birds reminds one of the Minivets.

225. *Zosterops palpebrosa* (The Indian White-eye).—A nest of "The Indian White-eye" found on the 23rd of April was built under an overhanging bank, from under which the earth had been washed away, and was suspended between roots which were thus laid bare.

237. *Pteruthius erythropterus* (The Red-winged Shrike Tit).—This is not an easy bird to observe. It is constantly hopping about high branches and generally contrives to put leaves between it and the observer. The note is a loud "Yup—Yĭpyüp" repeated several times. At Murree it was fairly common but less so in the Galis.

269. *Hypsipetes psaroides* (The Himalayan Black Bulbul).—A large variety of squeaky drongo-like notes are uttered by "The Himalayan Black Bulbul" usually when chasing each other about the tree tops, when at the nest or with their fledglings. A common note is a long drawn out "weenh" not unlike the distant sound of a young porker in the initial stages of being converted into bacon. It also has a pretty whistle which is one of the most attractive of the forest sounds in this part of the Himalayas. This note is "Whew-whe." "whew-whe", sometimes "whee-whe" and may be likened to the musical creaking of a rusty gate hinge. In music it is represented by the notes



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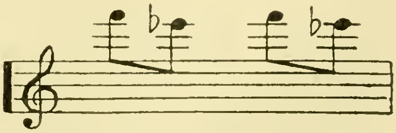

Usually preceding this whistle are a couple of the drongo-like notes above-mentioned which cannot be expressed in words but may be written "squeaky squeak." Another note sometimes, though rarely, heard sounds like "geă-gluck." Although the berries of *Viburnum fœtens* and other shrubs are the staple food of this Bulbul, it is, to a great extent in the breeding season, at any rate, insectivorous, and is often seen flycatching from the tree tops in the evenings. In the non-breeding season it is very gregarious and is often seen in flocks of 20 or 30. It was very numerous at Murree but not common in the Galis.

284. *Molpastes leucogenys* (The White-cheeked Bulbul).—On the 29th of April I saw a pair of "White-cheeked Bulbuls" on top of the ridge in Murree. Whether they nested on the hill or not I cannot say as I never saw them again. This is a very rare species at this elevation.

323. *Sitta leucopsis* (The White-cheeked Nuthatch).—The squeaky note of "The White-cheeked Nuthatch" as it perches on the highest twig of a dead Fir tree flicking its wings and jerking from side to side has been well described by Mr. C. H. T. Whitehead as "Pain" "Pain" pronounced like the French for bread. A common double note also is "Bawain" "Bawain" pronounced in the same way. It was by no means rare in Murree.

366. *Acrocephalus dumetorum* (Blyth's Reed-Warbler).—In the thick scrub on the south side of Murree ridge "Blyth's Reed-Warbler" was common and the song was to be heard till the beginning of June. I did not find any nests and do not think they bred this year in this neighbourhood as till the rains broke in July, there was practically no water on the hillside except at the water-taps and in the tank on top of the hill. In a normal year, however, I think it possible that they do breed about Murree, being, as is well known, the least aquatic of the genus. The song, although pretty in parts, has a good deal of the spitting, sputtering noise in it, so peculiar to the *Acrocephali*. The alarm note is a "chak" "chak." This little bird skulks much in thick scrub.

402. *Sylvia affinis* (The Indian Lesser White-throated Warbler.)—Towards the end of May "The Indian Lesser White-throated Warbler" became fairly common on the south side of Murree. I found one nest on the 28th of May which was deserted before the eggs were laid. It was built of fine grasses in a bush on the hillside. There were evidently several other nests about the bungalows. The song of this White-throat is a rapidly repeated "Găjıkăju găjikăju găjikăju" followed by a rapid "chivychirri chivychirri." The alarm note is very similar to that of the last species.

424. *Acanthopneuste magnirostris.* (The Large-billed Willlow-Warbler)—The nests of "The Large-billed Willow-Warbler" were only in the building towards the latter half of June. When out with Captain Skinner one day at Dunga Gali, an incomplete nest was found under the roots of a fallen tree. At Changla Gali two other nests had been located by Captain Skinner's searcher who subsequently obtained the eggs there. My ear could never catch the very high pitched notes of this Warbler, but both Colonel Buchanan and Captain

Skinner described the song to me as consisting of four or five double notes descending in the scale.

434. *Cryptolopha xanthoschista* (Hodgson's Grey-headed Flycatcher-Warbler).—In April Hodgson's Grey-headed Flycatcher Warbler was very common in Murree and a fair number appear to have remained to breed. This handsome little Warbler is very often seen accompanying parties of tits, and indeed its habits are if anything more tit than flycatcher like. The note is a plaintive "tyee-tyee".

450. *Horornis pallidus* (The Pale Bush-Warbler).—I am able to confirm my description of this bird's notes, published in "Notes on the Birds of Thandiani" except that at the end of the first prolonged whistle the note is more like "Tĕwyĭt—ătweet," and occasionally the first whistle is pitched in a lower key. "The Pale Bush-Warbler" was quite common on the south side of the Murree ridge. It keeps to thick scrub jungle and each pair appear to have a beat of 200 or 300 yards square into which no others of the species are permitted to intrude. The male is constantly patrolling his beat and warbling his wonderful song. The nest is very difficult to find, but in Murree it was out of the question making much of a search as they were evidently mostly in unsavoury spots below the bungalows. A nest I found on the 1st of June, and from which the young had evidently only just flown, was a globular structure about 4 inches in diameter of moss, wool, hair, and a little fine grass all felted together and built about a foot from the ground among some soft rank weed with an oleander-shaped leaf. The entrance was a small hole near the top just big enough to admit two fingers. The inside was densely lined with feathers. An egg taken below Changla Gali, from a nest in which there were 2 young, by Captain Skinner's collector, was deep chocolate brown in colour.

These birds appear to breed later in the inner hills than they do in Murree, as it was only in the third week in June that they were met with in Dunga Gali, Captain Skinner not having heard them before this, and at Thandiani it was not till the second week in July that I heard the song. I do not think that this is due to the birds moving into the inner hills for a second brood, as there was no diminution in the number of birds in Murree up to the middle of August. The volume of sound emitted by this little bird, when singing, is truly marvellous. On an open hillside it can be heard quite 200 yards away. Fair or foul weather does not affect its spirits and the song was to be heard all through the heavy monsoon of the present season and right up to the end of August.

476. *Lanius erythronotus* (The Rufous-backed Shrike).—At least two pairs of "The Rufous-backed Shrike" bred in Murree about the bungalows on the top of the hill. I did not find nests, which must have been on private ground; but the birds were often in evidence and their note of "gĕrlĕk" "gĕrlĕk" or "jŭlĕk" "jŭlĕk" followed by a yapping "yaon" "yaon" was a common sound near the water tanks. I also heard a male singing beautifully on one or two occasions. This is a high elevation (7,500 feet) for this Shrike. In the Kurram Valley I did not meet with it much above 6,000 feet.

505. *Campophaga melanoschista* (The Dark-grey Cuckoo-Shrike).—Although I have not been able to trace to "The Dark-grey Cuckoo-Shrike" a loud and slowly repeated note like "trwēēnh" "trwēēnh." I attribute it to this bird which was not common in Murree or the Galis.

558. *Hemichelidon sibirica* (The Sooty Flycatcher).—There were numbers of "Sooty Flycatchers" about in Murree up to the middle of May, thereafter they became very rare. In Dunga Gali and on Mozpuri (9,000 feet) I did not observe nearly so many of this species as I did in Thandiani last year. The song of this Flycatcher is a feeble little twitter. On one occasion at Changla Gali I observed this Flycatcher, singing from the top of a shrub about a foot high on the side of a mountain path, an unusual perch for the species.

579. *Stoparola melanops* (The Verditer Flycatcher).—A favorite site for the nests of "The Verditer Flycatcher" is under the roots of trees where the earth has been washed or fallen away leaving a deep recess. Even though the birds be marked home the nests are difficult to find in such places, as, being composed principally of moss, they match their surroundings exactly, moreover the light is often deficient in the deep cavities. Another, though less favorite site, is under bridges. This Flycatcher was common in Murree and more so at Dunga Gali. In the latter place Captain Skinner's searcher came on a Cuckoo which was evidently prospecting a nest of this species in which there were two hardset eggs of a second brood.

592. *Culicicapa ceylonensis* (The Grey-headed Flycatcher).— This Flycatcher occurred both in Murree and the Galis and was fairly common. A pair were observed in Murree on the 26th of June with nesting material in bill. Captain Skinner took eggs at Dunga Gali and came across a curious instance of apparently, two females sharing the same nest, an account of which he is sending to this journal. The note of this Flycatcher, in the breeding season, is a sharp "Tyŭ-jĭt" followed by a prolonged twittering note.

594. *Niltava sundara* (The Rufous-bellied Niltava).—The note of "The Rufous-bellied Niltava" when one approaches the nest is a grasshopper-like trill. I did not hear a song. I came across a male near the highest point in Changla Gali (9 000′) which evidently had a nest close by. That place and Murree were the only places I observed this Flycatcher. This species is more chat than flycatcher-like in habits. Two nests found in Murree were built in absurdly open situations in banks on the roadside. In one nest the eggs, in measurement and coloration were precisely similar to those of *Stoparola melanops*.

598. *Terpsiphone paradisi* (The Indian Paradise Flycatcher).—On the 18th of May at about 7,000 feet and below the bungalows on the South side of the Murree ridge I saw either an immature or female "Indian Paradise Flycatcher." The particular spot it was in was dry and waterless. This species may possibly breed just below Murree in normal seasons when there is water about.

608. *Pratincola caprata* (The Common Pied Bush-chat).—The male "Pied Bush-Chat" has quite a pretty song in the breeding season. It occurs on the Murree hill up to about 5,000 feet.

615. *Oreicola ferrea* (The Dark-grey Bush-Chat).—A nest of "The Dark-grey Bush-Chat" found in Murree in the vicinity of one of the Hotels was composed almost entirely of human hair (native). The lining was of horse-hair. The nest contained a full clutch of 5 eggs which were deserted. In July I use to see constantly a pair of these birds feeding their young of a second brood and accompanied by a fully fledged young bird of the first brood. This young bird "geezed" at me just like its parents whenever I went near the nest or near the young after they had left the nest and were in the surrounding scrub. I was almost prepared to see it helping its parents to feed its smaller brothers and sisters. I one day surprised two adult males hopping one after the other along the roadway like two sparrows, an action I had never before observed in this species. The incident was probably the prelude to a fight. The present was a bumper breeding-season for this little bird and numbers of young were successfully reared.

638. *Chimarrhornis leucocephalus* (The White-capped Redstart).—To see at Dunga Gali a pair of "White-capped Redstarts" with a brood of three young on the stream immediately below the engine house of the Murree water supply station was a pretty sight and especially gratifying as there were three ardent egg collectors in Dunga Gali at the time. Captain Skinner found the nest, just after the young were hatched, on a bank above the engine house. The natives in charge of the water supply station took quite an intelligent interest in these particular birds. While still feeding their brood the parents again started nesting in a weephole of the revetment wall of the embankment on which the engine house and tanks stood. This second nest was not more than 15 yards from the engine and within a foot of the top of the embankment where men were constantly passing to and fro. I learnt subsequently that this nest was never completed and that a third was built close by in another weephole of the same embankment. I had to leave Dunga Gali before the eggs were laid but I fear this handsome pair were not so lucky with their second establishment. These were the only birds of this species observed in the locality.

654. *Ianthia rufilata.*—(The Red-flanked Bush-Robin).—Captain Skinner informed me that he came across a female "Red-flanked Bush-Robin" in Dunga Gali.

673. *Merula castanea.*—(The grey-headed Ouzel).—The chorus of song of "The Grey-headed Ouzel" around Dunga Gali in June was delightful to listen to. Here this bird appeared to be highly successful in its nesting operations, but at Murree this and particularly the next species have their nests hurried and plundered by hillmen, gujars and others for the sake of the young, which are sold to natives, only to eke out, if they survive to maturity, a wretched existence behind the bars of a small cage in some foul bazaar. I appealed to the Forest Officials and the Murree Cantonment Committee for protection for these birds in Murree, with, I trust, some but fear, not much, measure of hope for the future. In addition to harrying by human beings the thrush family have to put up with another pest in Murree in the shape of monkeys (*Macacus*

rhesus) which are all too common in the woods around and which destroy nests, eggs, and young to a large extent. It is a question which is the worse depredator. Probably the palm in this respect should be given to *Homo Sapiens.* Three nests found were in the usual situations but a fourth was high up on the gnarled branch of a horse chestnut tree on the side of a steep hill at Dunga Gali. Some characteristic notes of this thrush's song may be rendered by the syllables "yēē-bre, yēē-bre, yēē-bre—diddiyit, diddiyit, diddiyit—yip bru, yip-bru."

676. *Merula boulboul* (The Grey-winged Ouzel).—Though not so loud the song of "The Grey-winged Ouzel" is even superior to and more varied than that of the last species. Many of the notes remind one of the song of The Black bird, *Merula merula.* Below the Kashmir and Gharial roads at Murree when, save for the occasional call of a Cuckoo, the mournful "Kroo"-"Kroo" of The Spotted Dove (*Turtur suratensis*) and the charming song of the present species, there is a lull in the babel of forest sounds, little effort is required to imagine oneself buried in the depths of a Surrey or Hampshire Wood in June. Not all are equally good songsters, but one bird heard between Dunga and Changla Gali on the 24th of June was the finest singing Thrush I have listened to either at home or in India. The variety and mellowness of the notes were remarkable. This Thrush is a doughty defender of hearth and home. I was watching a male bird singing while his mate sat on the nest close by, when an inquisitive "Black-throated Jay" (*Garrulus lanceolatus*) invaded the precincts of the nest. With an angry "churr" the male bird hurled the jay into the *Viburnum fœtens* scrub below and to judge by the sounds that issued therefrom "boulboul" was having all the fun. Presently the combatants separated and the jay reappeared flying unsteadily down the khud and minus some of his pteryllic adornment (if I may coin such an adjective) while the gallant Ouzel returned to his perch and resumed his song. Unfortunately this nest was pulled down by monkeys a few days later. It deserved a better fate. At Dunga Gali I saw a "Himalayan Whistling Thrush" (*Myiophoneus temmincki*) attacked in much the same fashion for unwittingly venturing into the vicinity of a nest of the present species. This Ouzel appears to be naturally of a pugnacious disposition, for a tame one I have possessed for some years, used when allowed out of his cage (his wings having been cut by his former owner a native) to "go for" the bare toes of the native servants and on one occasion he fairly put a man to flight. Curiously enough a pair of boots or shoes invariably excited his ire and it was most amusing to see him worrying the laces, the only part he could get a good grip of. He is, even now, always ready to "square up" to one's finger if introduced between the bars of his cage, and, as he daily devours almost his own weight in earthworms, he keeps in beautiful feather and fighting trim. Two nests of this Ouzel seen this year were built about 10 feet up against the trunks of trees. At Murree and in the Galis it occurs from 7,000 and 7,500 feet downwards, respectively, and would be far more common but for the depredations mentioned.

The trivial name of this species does not seem to me sufficiently descriptive. Although some of its feathers are edged with grey or white it is undoubtedly a 'Blackbird." "The Grey-winged Blackbird" would therefore seem a more appropriate name.

678. *Merula unicolor* (Tickell's Ouzel).—The nest of "Tickell's Ouzel" which is generally placed in the fork of a tree, often low down, is a very neat structure of moss held together by an inner coating of mud and lined with horse-hair and maiden-hair fern stems. The song is something as follows:—"Chellya, chellya, chirrali"—"cherlya, cherlya, chellya"—"chellya, chellya, juliu." At times the "chellya" note sounds very like "julia." The "juk juk" alarm note, common to the genus, is constantly used by this thrush when hunting for food.

690. *Petrophila erythrogastra* (The Chestnut-bellied Rock-Thrush).—The song of "The Chestnut-bellied Rock Thrush" bears some resemblance to that of "The Blue-headed Rock Thrush" (*P. cinclorhyncha*) and may be rendered as follows:—"Teetātewleedee-tweet tew" repeated several times and sometimes more varied as Teetătewleedee-tătewli-tatewyătweeyă." When the nest is approached or when young fledglings are about, a harsh angry "churring" note is uttered. I again noticed males hawking and catching winged insects, thus confirming my last year's observations as to this drongo-like habit in this species. Two solitary old males used to roost, regularly, in my bungalow at Murree, one in the gable of the roof, the other in a hole in the chimney. This species was fairly common, above 7,000 feet, both in Murree and the Galis.

698. *Oreocincla dauma* (The Small-billed Mountain-Thrush).—I met with "The Small billed Mountain-Thrush" two or three times in Murree as well as in the Galis.

741. *Pycnorhampus icteroides* (The Black and Yellow Grosbeak).—A nest of "The Black and Yellow Grosbeak" seen in Murree was built high up in a medium sized Silver Fir and must have been almost entirely composed of bark and fibre of "The Black Poplar," as I watched a pair tearing off great beak-fuls of this stuff and flying to the nesting site with it. Another nest in Dunga Gali was in a medium sized Yew tree near the top but in a most accessible situation. The three eggs which it contained were greenish white with, in the case of two of the eggs, a zone of blackish brown spots and the scribbling and flagellate markings, so common in the eggs of some of the *Emberizinæ*, round the larger end. In the third egg this zone of markings was round *the smaller end*. Captain Skinner who was with me secured this clutch. These Grosbeaks were abundant around Dunga Gali and it was not uncommon to see parties of them feeding on the roads. On the ground they progress in hops like the majority of the "*Fringillidæ*." A song note of a male heard this year was "tratrui-tree." The note of both sexes when feeding is a "chuck" "chuck."

744. *Mycerobas melanoxanthus* (The Spotted-winged Grosbeak).—I was out with Captain Skinner at Dunga Gali when his searcher, who by the way was Colonel Buchanan's man lent to him, showed us a nest of "The Spotted Winged

Grosbeak" which he had located. It was built on a slender branch of a Yew tree on the side of a steep hill, and contained three beautifully marked eggs. The female, which sat very close, was shot by Captain Skinner off the nest. I will leave the description of this interesting nest and clutch of eggs to him, as he is sending an account of them to this journal. This Grosbeak was rare, though on the 23rd of June I came across, in one spot, in Dunga Gali, quite a number of them. The note is a pleasing, mellow and rather oriole-like whistle resembling the syllables "Tyŏp-tyū" or "Tyŏp-tyō." Sometimes preceding or following this note is a remarkably human note like the exclamation "ah" when pronounced with an ascending inflection. When flying there is a note like "Chărrăruk." The unripe fruit of "The Wild Cherry tree" is eagerly devoured, and the berries of *Viburnum fœtens* also form part of the dietary of these Grosbeaks at this season.

772. *Hypacanthis spinoides* (The Himalayan Greenfinch).—The very heavy and almost incessant monsoon of the present season in the Punjab Himalayas probably frustrated all attempts at nesting on the part of the luckless "Himalayan Green finch." The birds were rather rare and I only saw two or three pairs. Captain Skinner found one or two washed out nests at Dunga Gali.

805. *Chelidon kashmiriensis* (The Kashmir Martin).—In the verandahs of bungalows in the vicinity of the water tanks in Murree "The Kashmir Martin" now breeds in considerable numbers. As in the case of the Martins in Thandiani, I feel almost certain that "The European House Martin" occurs in some of these colonies. In one house in Murree where the present species started nesting operations, the nests were destroyed and cleared away daily, but the unfortunate birds were still attempting to build when I left at the end of August. What becomes of the eggs under such circumstances it would be hard to say. At Changla Gali several Martins had their nests in the Dâk bungalow, but these were not visible, the birds utilizing holes between the wall and the sloping roof. This was also the case with some birds in Dunga Gali and in Thandiani. Whether this habit is the result of the constant destruction of nests, or the difficulty in procuring mud (I do not think the usual mud nests are built in these holes as I never saw mud being carried in) in the hills, especially in a dry breeding season like the present, it is impossible to say; but such adaptation (if it be the case) of nesting habits to circumstances must tend greatly to the preservation of the species.

822. *Hirundo nepalensis* (Hodgson's Striated Swallow).—This year "Hodgson's Striated Swallow," nested in at least one bungalow near the water tanks in Murree.

946. *Gecinus squamatus* (The Western Himalayan Scaly-bellied Green Woodpecker).—The call of "The Western Himalayan Scaly-bellied Green Woodpecker" is a wild sounding note like "Klēē-gŭ." When hunting for food a constant "tjăpk," "tjŭpk," "tjupk," "tjăpk" note is kept up. This note, rapidly repeated, constitutes the alarm cry. This Woodpecker prefers the more

open hillsides and is less of a forest bird than the next species. Both are common in Murree and the Galis.

950. *Gecinus occipitalis* (The Black-naped Green Woodpecker).—In addition to the cry or callnote consisting of a single, rather high pitched, though mellow, whistle repeated three times, sometimes of three whistles descending the scale in half tones "The Black-naped Green Woodpecker" has a musical note like "Piňk" when feeding, and an alarm cry similar to that of the last species, though less harsh.

960. *Hypopicus hyperythrus* (The Rufous-bellied Pied Woodpecker).—I found "The Rufous-bellied Pied Woodpecker" very common at Dunga Gali. The cry of this Woodpecker is a long rattling, but not loud, sound running down at the finish. It is difficult to describe but may be likened to the rapid running down of the works of a small clock with a broken mainspring or to the rapid running out of a large fishing reel. This was the only note of this species heard and apparently the common "jipk" "jipk" note of some of the *Dendrocopii* is not used.

967. *Dendrocopus macii* (The Fulvous-breasted Pied Woodpecker).

969. *Dendrocopus auriceps*.—(The Brown-fronted Pied Woodpecker).—My observations on "The Fulvous-breasted Pied Woodpecker" and "The Brown-fronted Pied Woodpecker" confirm those of Colonel Rattray as regards the rarity or absence of both in the Galis and the common occurrence of the latter in Murree. The former, however, I found rare in Murree. The note of both species somewhat resembles that of *Hypopicus hyperythrus*, but compared with *Dendrocopus himalayensis* they are silent birds.

1004. *Indicator xanthonotus* (The Yellow-backed Honey-guide).—I had the pleasure of seeing the rather rare "Yellow-backed Honey-guide" at close quarters on the 29th of April in Murree. A bird sitting on a bare bough of a chestnut tree arrested my attention. From below it was hard to identify with its non-descript coloured lower parts and short finch-like bill. It however remained in the same spot for quite half an hour and allowed me to walk round and examine it leisurely. As I left the spot it still sat, but on gaining the path above I heard a rustle of wings behind me and turned to see the same bird pitch on to the bare bough of a tree below the path and level with me, not more than 10 yards away. There it sat quite tamely and I could examine every feather in the plumage. Presently it flew away in the direction opposite to which I was going. I was anxious to find a nest and so returned to the spot about three hours later, but for some time could not see the bird I sought. Suddenly a streak of yellow crossed the path and flew up the hill. I dashed after it through the thick undergrowth and came on a Honey-guide at a hole in a tree when I could see it was feeding on bees which were swarming round the hole. After feeding, it flew into a tree close by and shortly after disappeared. Whether this was the same bird I had seen in the morning or not I am unable to say, but taking both occurrences together, the bird's actions were, to say the least of them, suggestive. I searched the vicinity carefully but could not find a nest. About three weeks later I saw an example of this species bathing in a small stream near the spot where I had first seen it. Colonel Buchanan informed me that when stationed at Changla Gali he had on several occasions come across the bird there, and Mr. C. H T. Whitehead saw an example when passing through Dunga Gali early in July of the present year. The attitude of this Honey-guide in a tree is very dove like. It sits with head sunk on breast, feathers rather puffed out and wings drooping so as to display the vivid yellow patch down the lower back. According to Colonel Buchanan it has a peculiar note which he was unable to describe to me. It is a very tame bird and is, I think, rarely to be found far from water.

1005. *Megalæma marshallorum* (The Great Himalayan Barbet).—The cry of " The Great Himalayan Barbet" usually commences with a husky " Pee-ho" as the syrinx gets into working order this changes to "Pillo" shortly developing into the characteristic note "Pyillŏ" "Pyillŏ" which is repeated *ad nauseam*. Towards the end of the performance the note sometimes changes to "Pyĭllo" "Pyĭllo." Another note often heard is a rapidly repeated "gyŏk" "gyŏk" "gyŏk" and occasionally a harsh note like "karr-r" which, as in the case of the characteristic call are uttered with reiteration. Both of the latter notes are very gull-like. The cry of this bird was still occasionally to be heard when I left Murree at the end of August.

1072. *Cypselus leuconyx* (Blyth's White-rumped Swift).—At the bridge, a mile from Dunga Gali, on the old Gali Road I watched a colony of "Blyth's White-rumped Swifts" prospecting for nesting sites in the gorge above the bridge. The cliff face did not, apparently, offer sufficient inducements as they passed on to nest elsewhere.

1104. *Cuculus canorus* (The Cuckoo).—Abnormal notes of "The Cuckoo" heard this year were " Gyuk-coo", the second syllable husky and pitched in a higher key than the first, the first syllable repeated three times in succession, and a hoarse croak following the second syllable. In the first two instances the notes were evidently due to some defect in the syrinx and in the last to an expulsion of residual air in the bronchial tubes. The familiar call is sometimes uttered on the wing and when this is the case I think it will usually be found that a female is being pursued or another male being chased away. Courtship is conducted with many husky chuckles and croaks. The attitude when calling is generally horizontal with wings drooping and tail elevated and there is a slight swaying oscillating movement more pronounced in the tail. Sometimes the attitude is semi-erect. There is considerable distension and protrusion of the lower throat when uttering the call, but not so pronounced as in the Doves and Pigeons. While on migration to the hills early in April this year a few Cuckoos remained in Bannu for about a week and it was interesting to hear the familiar call being acquired. The first few attempts resulted in nothing more than husky croaks. In the course of a few hours a feeble imitation of the call was attained and this gradually strengthened day by day. Although some individuals maintain the vigour of their call almost unimpaired till the end of the season, in the case of the majority the call gets feebler and feebler and is usually repeated once or twice only. The hoarse chuckle and tri-syllabic note are rarely heard after the first of July. The last date on which the Cuckoo's call was recorded by me in Murree was the 16th of July.

1105. *Cuculus saturatus* (The Himalayan Cuckoo).—" The Himalayan Cuckoo " sometimes utters the same hoarse chuckle, at the commencement of its call, as the last species. As in the case of *Megalæma marshallorum* often several husky attempts at the call are made before the syrinx works clearly. This Cuckoo usually utters its deep call from the centre of a tree and it is consequently not easy to observe. Captain Skinner informs me that at each syllable the head is jerkily thrown forward somewhat after the manner of the domestic cock when crowing. The female's notes, when heard close by, sound like " quoick " " quoick." Both male and female appear to be more lively at dusk. I did not hear this Cuckoo's call after the last day of June.

1141. *Palæornis schisticeps* (The Slaty-headed Paroquet).—The capacity of " The Slatey-headed Paroquet " for regurgitating food is great as is also the appetite of the young. I watched a young bird at Changla Gali being fed by one of its parents for fully five minutes. Quite a considerable quantity of food appeared to have been brought up in this time but the young one still clamoured for more. A kissing noise is made by the latter when asking for food. This Paroquet's screech is a shrill, though pleasing, " trwēē-ē". When going about in family parties there are some pretty notes like " Truēē-trui tru". This species is also in need of protection in the breeding season in Murree, the young being far too frequently taken and caged.

1173. *Scops giu* (The Scops Owl).—While staying with me in the latter part of June in Murree Mr. C. H. T. Whitehead shot a male example of " The Scops Owl ". The testes showed the bird was not at the time in breeding condition.

1283. *Sphenocercus sphenurus* (The Kokla Green Pigeon).—The handsome " Kokla Green Pigeon " was common in Murree but less so in the Galis. The peculiar note of this Pigeon, from which the trivial name is evidently derived, may be rendered as follows :—" Kō-Klă-Kŏi, ŏĭ, ŏĭ, ŏĭ, oilli, illiō—Kla."

1305. *Turtur ferrago* (The Indian Turtle-Dove)—Large flocks of " The Indian Turtle-Dove" migrated through Murree towards the end of April but were very rare there as a breeding species, if they occurred at all as such. At Dunga Gali they were very common. The note is a deep " Krōō-ōō kră krukroo " and not as printed in " Notes on the Birds of Thandiani. "

1307. *Turtur suratensis* (The Spotted Dove).—I was puzzled to identify the small Dove which was common round Murree during the breeding season and on 21st May shot one for the purpose. It turned out to my surprise to be " The Spotted Dove." Although " The Fauna " states that this bird ascends the Himalayas to 7,000 feet I was not prepared to meet with it so far west as Murree. The example shot was a ♂, one of a pair, with testes fully developed but curiously enough still in moult. The note of this Dove is " cuckŭkăkrōō-krōō-krōō-krōō."

1333. *Catreus wallichi* (The Cheer Pheasant).—A bunch of feathers found one day in Murree, adhering to a bush in thick forest were, I think, back feathers of "The Cheer Pheasant" and evidently belonged to some luckless individual killed by a jackal or hill-fox. The occurrence of this bird in Murree is not improbable as an example was procured by Major Venour in Dunga Gali, *vide* Vol. XVII, p. 812 of this journal.

1342. *Lophophorus refulgens* (The Monál).—At Dunga Gali I met Mr. J. Donald, at that time, Deputy Commissioner of Hazara, who informed me that a few days previously he had flushed a "Monál" on Mozpuri (9,000′).

1482. *Scolopax rusticola* (The Woodcock).—By mistake I omitted "The Woodcock" from "Notes on the Birds of Thandiani." It has been seen and I think shot on that hill and in all probability breeds there. This year I visited a well-known breeding resort of Woodcock at Dunga Gali but did not find any nests or see any birds.

ON THE FLORA OF CUTCH.

BY

E. BLATTER, S.J.

PART II.

(*Continued from page 777 of Vol. XVIII*).

56. *Solanaceæ.*—

(279) Solanum nigrum, L.—In cultivated ground ; flowers: Oct.-Jan.—Sind, Deccan, Konkan, S. M. Country—Temperate and tropical regions of the world.

(280) Solanum xanthocarpum, Schrad. & Wendl.—Sind, Deccan, Konkan—All over India, Ceylon, S. E. Asia, Malaya, Tropical Australia, Polynesia.

(281) Solanum indicum, L.—Common.—Deccan, Konkan—Tropical India, Ceylon, Malaya, China, Philippines.

(282) Solanum trilobatum, L.—Not common ; flowers : Dec.-Jan.—Gujarat, Deccan, S. M. Country—W. Peninsula, Ceylon, Malay Peninsula.

(283) Solanum tuberosum, L.—Cultivated—Indigenous in America.

(284) Solanum melongena, L.—Cultivated.

(285) Withania somnifera, Dunal.—Rare.—Sind, Gujarat, Deccan, Konkan—Drier regions of India, Ceylon, Mediterranean regions, Canaries, Cape of Good Hope.

(286) Lycium barbarum, L.—Common ; flowers : Nov.-Dec.—Sind, Gujarat—Panjab, Beluchistan, Afghanistan, Persia.

(287) Datura fastuosa, L.—var. alba, C. B. Clarke.—Common ; flowers : Sept.-Dec.—Throughout the Presidency.

(288) Lycopersicum esculentum, Mill.—Cultivated.—Indigenous in Tropical America.

(289) Nicotiana tabacum, L.—Cultivated.—Probably indigenous in S. America.

(290) Capsicum frutescens, L.—Cultivated.

57. *Scrophulariaceæ.*—

(291) Celsia coromandeliana, Vahl.—Flowers : Jan.-May.—Sind, Gujarat, Deccan, Konkan—All over India, Ceylon, Afghanistan, Ava, China.

(292) Linaria ramosissima, Wall.—Pretty common in rocky places.—Throughout the Presidency—Throughout India, Afghanistan, Ava.

(293) Veronica anagallis, L.—Flowers : Nov.-Jan.—Deccan, Konkan—Western Peninsula, Panjab, Kashmir, Bengal, Assam, Bhotan N. Asia, S. Africa, Europe, N. America.

(294) Lindenbergia urticæfolia, Link. & Otto.—Flowers : Nov.-Dec.—Sind, Deccan—All over India, Afghanistan.

58. *Orobanchaceæ.*—

(295) Orobanche ægyptiaca, Pers.—Gujarat, Deccan—Plains of India, Central and Western Asia.

59. *Bignoniaceæ.*—

(296) Tecomella undulata, Seem.—Not common.—Sind, Gujarat, Deccan—Western Peninsula, Panjab, Rajputana, Beluchistan, Arabia.

(297) Millingtonia hortensis, L.f.—In gardens—Probably a native of Burma and the Malay Archipelago.

60. *Pedaliaceæ*—

(298) Pedalium murex, L.—Very common; flowers: Sept.-Dec.—Gujarat, Konkan, S. M. Country—India, Ceylon, Tropical Africa.

(299) Sesamum indicum, L.—Cultivated—Probably indigenous in Tropical Africa.

61. *Acanthaceæ.*—

(300) Blepharis sindica, T. Anders.—Sind, Gujarat.—Panjab.

(301) Asteracantha longifolia, Nees.—Common; flowers: Aug.-Jan.—Deccan, Konkan—Throughout India, Ceylon, Tropical and South Africa.

(302) Ruellia patula, Jacq.—Flowers: Aug.-Dec.—Sind, Deccan, S. M. Country—W. Peninsula, Rajputana, Bandelkand, Ceylon, Arabia, Tropical Africa, Ava.

(303) Barleria prionitis, L.—Common; flowers: Oct.-Jan.—Sind, Gujarat, Deccan, Konkan—All over India, Tropical Asia, Tropical and South Africa.

(304) Barleria cristata, L., var. dichotoma, Prain.—Probably cultivated; flowers: Dec.

(305) Lepidagathis cristata, Willd.—Common; flowers: Oct.-March.—Deccan, Konkan, S. M. Country—Western Peninsula.

(306) Rungia repens, Nees.—Common; flowers: Nov.-Jan.—Deccan, Konkan, Kanara, S. M. Country—All over India, Ceylon.

(307) Justicia heterocarpa, T. Anders.—Flowers: Oct.-Dec.—Sind, Gujarat—Panjab, Tropical Africa.

(308) Justicia diffusa, Willd.—Flowers: Oct.-Dec.—Sind, Deccan—W. Peninsula, Panjab, Ceylon, Rangoon, Siam.

(309) Justicia simplex, D. Don.—Flowers: Nov.-Dec.—Sind, Gujarat, Konkan, Kanara, S. M. Country—W. Peninsula, Central India, Kashmir, Bengal, Abyssinia, Malay Islands.

(310) Peristrophe bicalyculata, Nees.—Flowers: Oct.-Nov.—Sind, Gujarat, Deccan, Konkan, Kanara—All over India, Tropical Africa.

62. *Verbenaceæ.*—

(311) Lippia nodiflora, Michaux.—In sandy soil.—Sind, Gujarat, Deccan—India generally, Ceylon, Africa, most tropical and subtropical countries.

(312) Premna integrifolia, L.—Near the coast.—Konkan, Kanara—Ceylon, Andamans, Nicobars, Malaya.

(313) Clerodendron phlomidis, L. f.—Not common, in hedges; Gujarat Deccan, Konkan, S. M. Country—Dry parts of India, Ceylon.

(314) Avicennia officinalis, L.—Along the coast.—Konkan, Kanara.—Salt-marshes and tidal creeks of India, Ceylon, Malaya, shores of the Indian and Pacific Oceans.

63. *Labiatæ.*—

(315) Ocimum sanctum, L.—Probably cultivated.—Throughout India (cultivated), Malay Archipelago, Australia, Arabia, W. Asia.

(316) Ocimum canum, Sims.—Flowers: Sept.-Jan.—Deccan, Konkan, S. M. Country—Plains and lower hills of India, Ceylon, Java, W. Asia, Tropical Africa, Madagascar.

(317) Ocimum basilicum, L.—Cultivated.—A native of the Panjab.

(318) Anisomeles ovata, R. Br.—Common in the Presidency except Sind—Throughout India, Ceylon, Malay Archipelago, China, Philippines.

(319) Leucas urticæfolia, R. Br.—Flowers: Nov.-Dec.—Sind, Gujarat, Deccan—W. Peninsula, Panjab, Bengal, Beluchistan, Arabia Abyssinia.

(320) Leucas linifolia, Spreng.—Common; flowers: Oct.-Nov.—Deccan, Konkan—Plains of India, Mauritius, Java, Philippines.

(321) Leucas cephalotes, Spreng.—Common; flowers: Nov.-Dec.—Gujarat —W. Peninsula, Panjab, Bengal, Assam, Himalayas, Afghanistan.

(322) Salvia ægyptiaca, L., var. pumila, Hook. f.—Flowers: Nov.-Dec.—Sind, Gujarat, Deccan—W. Peninsula, Panjab, Afghanistan, Beluchistan.

64. *Nyctaginaceæ.*—

(323) Bœrhaavia diffusa, L.—Very common; flowers: Nov.-Dec.—Throughout the Presidency—All over India, Ceylon, tropical and subtropical Asia, Africa and America.

(324) Bœrhaavia repanda, Willd.—Very common; flowers: Oct.-Dec.—Gujarat, Deccan, Konkan—India, Ceylon, Beluchistan.

(325) Bœrhaavia verticillata, Poir.—Very common; flowers: Sept.-Jan.—Sind, Gujarat, Deccan, Konkan—W. Peninsula, Panjab, Afghanistan, Beluchistan to Syria and Tropical Africa.

(326) Bougainvillea spectabilis, Willd.—Cultivated.—Indigenous in Brazil.

65. *Amarantaceæ.*—

(327) Celosia argentea, L.—Pretty common; flowers: Oct.-Dec.—Throughout the Presidency—All over India, Ceylon, Tropical Asia, Africa, and America (either cultivated or introduced).

(328) Amarantus gangeticus, L., var. tristis, Prain.—Cultivated as a pot-herb.

(329) Amarantus blitum, L., var. ole acea, Hook f.—Cultivated.

(330) Amarantus viridis, L.—In gardens and cultivated ground.

(331) Amarantus polygamus, L.—In cultivated ground: flowers: Dec.-March—India, Ceylon, most hot countries.

(332) Amarantus tenuifolius, Willd.—Bengal, Panjab, W. India, Tropical Africa.

(333) Ærua javanica, Juss.—Very common ; flowers: Sept.-Dec.—Sind, Deccan—W. Peninsula, Central India, Panjab, Burma, Ceylon, Arabia, Tropical Africa, Cape de Verde Islands.

(334) Ærua monsoniæ Mart.—Very common ; flowers: Oct.-Jan. —S. M. Country—Central India, W. Peninsula, Bengal, Burma.

(335) Nothosærua brachiata, Wight.—Flowers: Nov.-Dec.—Sind, Gujarat, Konkan—Western Peninsula, Burma, Ceylon, Mauritius, Tropical Africa.

(336) Achyranthes aspera, L.—Common ; flowers: Nov.-Jan.—Sind, Deccan, Konkan —Throughout India, Ceylon, Tropical Asia, Africa, Australia, and America.

(337) Pupalia atropurpurea Moq.—Gujarat—W. Peninsula, Nepal, Bengal, Malaya, Ceylon Java, Philippines, S. Africa.

(338) Pupalia lappacea, Moq.—Flowers: Sept.-Dec.—Sind, Gujarat, Deccan, S. M. Country—W. Peninsula, Behar, Panjab, W. Tropical Hymalaya, Tropical Asia and Africa.

(339) Alternanthera triandra, Lam.—flowers: Aug.-Dec.—Throughout the Presidency —All warm countries.

66. *Chenopodiaceæ.*—

(340) Atriplex stocksii, Boiss.—Flowers: Dec.-Jan.—Sind, Gujarat.

(341) Salicornia brachiata, Roxb.—Flowers: Nov.-Dec.—Gujarat—Bengal, Ceylon.

(342) Suæda fruticosa, Forsk.—Flowers: Nov.-Dec.—Sind, Gujarat —N.-W. India, Paujab Africa, America.

(343) Suæda nudiflora, Moq.—Konkan, Orissa—W. Peninsula Ceylon.

(344) Haloxylon recurvum, Bunge.—Flowers: Nov.-Dec.—Sind—Coimbatore, Burma Panjab Afghanistan Yunnan.

(345) Salsola fœtida, Del.—Flowers: Dec.—Sind—Panjab, Beluchistan, Persia, Arabia, N. Africa.

67. *Polygonaceæ.*—

(346) Polygonum plebejum, R. Br., var. indica, Hook, f.—Common.—Deccan, Konkan, S. M. Country, Kanara.

(347) Polygonum glabrum, Willd.—Flowers: Oct.-Feb.—Sind, Deccan, Konkan, Kanara—All over India, Ceylon, Australasia, China, Africa, America.

68. *Aristolochiaceæ.*—

(348) Aristolochia bracteata, Retz.—Flowers: Sept.-Dec.—Sind, Gujarat, Deccan, Konkan—Bengal, Ceylon, Arabia, Tropical Africa.

69. *Euphorbiaceæ.*—

(349) Euphorbia neriifolia, L.—Very common on rocky ground ; flowers: March.—Sind, Gujarat—N. W. Himalaya, Pegu, Burma.

(350) Euphorbia hypericifolia, L., var. parviflora, Hook. f.—Very common; flowers: Aug.-Dec.—Sind, Gujarat, Deccan, Konkan.—Throughout the Tropics except Australia and the Pacific Islands.

(351) Euphorbia pilulifera, L.—Common; flowers: More or less throughout the year.—Most tropical and subtropical regions.

(352) Euphorbia thymifolia, L.—Very common; flowers: All the year round.—Sind, Deccan—Plains and lower hills of India, Ceylon, all hot countries except Australia.

(353) Euphorbia tirucalli, L.—Common in hedges—Indigenous in America.

(354) Fluggea leucopyrus, Willd.—Throughout the Presidency—Panjab, Burma, Ceylon.

(355) Phyllanthus reticulatus, Poir.—Flowers: Throughout the year—Gujarat, Konkan, Kanara, S. M. Country—Tropical India, Ceylon, Tropical Africa, China, Malay Islands.

(356) Phyllanthus maderaspatensis, L.—Deccan, S. M. Country—Drier parts of India, Ceylon, Tropical Africa, Arabia, Java, China, Australia.

(357) Phyllanthus niruri, L.—Common; flowers: Nov.-Dec.—Deccan, Konkan—All over India, Ceylon, in the Tropics generally except Australia.

(358) Chrozophora prostrata, Dalzell.—Sind, Deccan, S. M. Country.—Throughout India, N. Africa.

(359) Ricinus communis, L.—Cultivated—Probably indigenous in Africa.

70. *Urticaceæ.*—

(360) Ficus bengalensis, L.—Planted.

(361) Ficus retusa, L.—Planted.

(362) Ficus religiosa, L.—Planted.

(363) Ficus tsiela, Roxb.—Planted.—Western Peninsula, Central Provinces, Ceylon.

71. *Ceratophyllaceæ.*—

(364) Ceratophyllum demersum, L.—In tanks and ponds.—All temperate and tropical regions.

72. *Hydrocharitaceæ.*—

(365) Hydrilla verticillata, Presl.—In tanks; flowers: Dec.—Sind, Deccan, Konkan.—Central Europe, Mauritius, Madagascar, Tropical Asia and Australia.

(366) Vallisneria spiralis, L.—In tanks—Sind, Deccan, Konkan—All over India, Warm regions of the Old and New World.

73. *Liliaceæ.*—

(367) Asparagus racemosus, Willd; var. javanica, Baker.—Gujarat, Deccan, Konkan, Kanara, S. M. Country—W. Peninsula, Java.

(368) Asphodelus tenuifolius, Cav.—Flowers: Nov.-Feb.

(369) Allium cepa, L.—Cultivated in the cold season.

(370) Allium sativum, L.—Cultivated.

74. *Commelinaceæ.*—
   (371) Commelina nudiflora, L.—Common; flowers: Dec.—Deccan, Konkan, S. M. Country—In many tropical and subtropical countries.
   (372) Commelina bengalensis, L.—Common; flowers: Sept.-Dec.

75. *Palmaceæ.*—
   (373) Phœnix sylvestris, Roxb.—Cultivated.—Throughout India.
   (374) Cocos nucifera, L.—Cultivated.

76. *Pandanaceæ.*—
   (375) Pandanus tectorius, Soland.—Planted.—Sea coast of the Indian Peninsula, Burma, Andamans.

77. *Aroidaceæ.*—
   (376) Colocasia antiquorum, Schott.—Rare—Cultivated in all hot countries.

78. *Lemnaceæ.*—
   (377) Wolffia arrhiza, Wimm.—In tanks.—Throughout India.

79. *Naiadaceæ*—
   (378) Potamogeton indicus, Roxb.—In ponds and tanks.—Throughout the plains of India, Sikkim up to 9,000 ft., Burma, Ceylon—Malay and Sandwich Islands.
   (379) Naias minor, All.—In still sweet water.—Throughout India and Ceylon—Old World generally.

80. *Cyperaceæ.*—
   (380) Kyllingia triceps, Rottb.—From N.-W. India and Sind to Bengal, Burma and Ceylon.—Africa, China, Australia.
   (381) Pycreus polystachyus, Beauv.—Near the coast.—All warm especially maritime regions.
   (382) Cyperus haspan, L.—Throughout India—All warm regions.
   (383) Cyperus arenarius, Retz.—On the seacoast.—From Sind to Ceylon and Orissa, Panjab—Persia, Arabia.
   (384) Cyperus conglomeratus, Rottb.—Sind.—From Sind to N. Africa.
   (385) Cyperus iria, L.—In rice-fields.—Throughout India—Old World generally.
   (386) Cyperus bulbosus, Vahl.—Sind, Aligurh, Deccan Peninsula, Ceylon—Tropical Africa, Asia and Australia.
   (387) Cyperus stoloniferus, Retz.—On the sandy sea shore—From Sind to Ceylon, Malay Peninsula—Mauritius, China, Malaya, Australia.
   (388) Cyperus pygmæus, C. B. Clarke.—From Kashmir to Burma and Ceylon—All warm regions except Europe.
   (389) Eleocharis plantaginea, Br.—From Sind, Saharanpore and Assam to Ceylon and the Malay Peninsula—Tropics of the Old World.
   (390) Fimbristylis tetragona, Br.—Throughout India except the North-West, up to 3,000 ft.; from Nepal and Bombay to Ceylon and Tavoy—E. Asia, Australia.
   (391) Fimbristylis dichotoma, Vahl.—Throughout India up to 4,000 ft.—Warm regions of the Old World.

(392) Fimbristylis ferruginea, Vahl.—Throughout India up to 3,000 ft.—All warmer regions.

(393) Fimbristylis spathacea, Roth.—From Sind and Orissa to Ceylon and Singapore.

(394) Scirpus supinus, L.—India and Ceylon.—Old World generally and America.

(395) Scirpus grossus, L.—Throughout India up to 2,000 ft.—Malaya, Tonkin, Philippines.

(396) Scirpus littoralis, Schrad.—From Kashmir (3,500 ft.) and Bengal to Ceylon.—W. Asia, Africa, Europe, Australia.

91. *Graminaceæ.*—

(397) Paspalum distichum, L.—Bombay, on the sea-shore, Gujarat.—All over the tropics.

(398) Paspalum sanguinale, Lamk.—Throughout India and in all warm countries.

(399) Panicum colonum, L.—Sind—All over India, Australia.

(400) Panicum turgidum, Forsk.—Gujarat, Sind—Central India, Beluchistan, Arabia, Egypt.

(401) Panicum crus-galli, L., var. frumentaceum.—Cultivated.—Hotter parts of Asia and Africa.

(402) Spinifex squarrosus, Kunth.—On the sandy coast.—India, Burma, Ceylon, Java, China.

(403) Pennisetum typhoideum, Rich.—Cultivated.—All over India and Ceylon.

(404) Pennisetum dichotomum, Delile.—On sand hills; Sind, Gujarat.

(405) Pennisetum setosum, Rich.—Gujarat, Sind—Bundelkund, Central Provinces, Africa, Tropical America.

(406) Pennisetum cenchroides, Rich.—Sind, Gujarat, Deccan—Western India, from Kashmir to the Upper Gangetic Plain, and Southward, Tropical Africa, Canaries, Sicily.

(407) Cenchrus biflorus, Roxb.—Konkan, Sind—Coromandel, Rajpootana, Upper Gangetic Plain, Panjab, Beluchistan, Arabia, Africa.

(408) Trachys mucronata, Pers.—On the sea-shore.—Gujarat—Deccan Peninsula, Ceylon, Jaffna.

(409) Tragus racemosus, Hall.—Sind, Gujarat, Deccan, from Kashmir to Upper Bengal and southward to Ceylon, Burma, warm regions generally.

(410) Hygrorhiza aristata, Nees.—Gujarat, Deccan—Upper and Lower Gangetic Plains, Assam, Chitagong, Pegu, Ceylon, Tonkin.

(411) Saccharum spontaneum, L.—Warmer parts of India and Ceylon, up to 6,000 ft.—Warm regions of the Old World, East Australia.

(412) Saccharum officinarum, L.—Cultivated.

(413) Saccharum arundinaceum, Retz.—Throughout the plains and low hills of India—Ceylon, China.

(414) Ischœmum pilosum, Dalz. and Gibs.—Khandesh, Deccan—Mysore, Asirghar, Bellary, Chanda.

(415) Elionurus royleanus, Nees.—Sind, Gujarat.—Upper Gangetic Plain, Arabia, Abyssinia, Cape Verd Islands.

(416) Andropogon foveolatus, Del.—Sind, Kandesh, Deccan—Drier parts of India, Tropical Africa, Cape Verd Islands.

(417) Andropogon sorghum, Brot.—Cultivated —Warmer parts of Asia, Africa, Europe.

(418) Andropogon annulatus, Forsk.—Deccan, Gujarat—Throughout the hills and plains of India, Tropical Africa, China, Australia, Pacific.

(419) Aristida adscenscionis, L.—Gujarat, Deccan—Throughout the plains and low hills of India, up to 8,000 ft., most warm countries.

(420) Aristida funiculata, Trin. and Rupr.—Sind, Deccan, S. M. Country—Plains of the Panjab, Rajputana, from the Konkan southward, Beluchistan, Arabia, Tropical Africa.

(421) Gracilea royleana, Nees.—Sind, Deccan, Konkan—Panjab Plain, Rajputana, Sind, Central India, Socotra, Nubia.

(422) Cynodon dactylon, Pers.—Throughout India, Burma, and Ceylon, up to 5,000 ft.—All warm countries.

(423) Chloris barbata, Swar.—Throughout the plains of India, Burma, and Ceylon—Tropics generally.

(424) Eleusine ægyptiaca, Pers.—Throughout the low country of India, Burma, and Ceylon, Malacca—warm regions of the Old World.

(425) Leptochloa chinensis, Nees.—Gujarat, Konkan—Throughout India and Barma, Ceylon, Malaya, China, Japan, Australia.

(426) Phragmites karka, Trin.—All over India, Afghanistan, Tropical Asia, Africa, Japan, Australia.

(427) Eragrostis ciliaris, Link.—Sind, Gujarat, Deccan, Konkan—All over India, Arabia, Tropical Africa.

(428) Halopyrum mucronatum, Stapf.—Sind, Gujarat, Konkan, Kanara—Coasts of Western India and Ceylon, Arabia, Tropical Africa.

(429) Æluropus villosus, Trin.—On salt ground.—Sind, Gujarat—Sandy shores of the Deccan Peninsula and Ceylon, salt plains of the Panjab, Afghanistan, Persia, Arabia, Mediterranean region.

(430) Triticum vulgare, L.—Cultivated.

(431) Hordeum vulgare, L., var. hexastichon, Aitchis.—Cultivated.

In order to give a more complete idea of the vegetation of Cutch we shall add a few notes on the cultivated plants[1] of that Province. The arable area of Cutch is estimated at about 1,500,000 acres. It consists, generally speaking, of a valley formed between the Dora Hills and the Charwar range, the extensive plain between the Dora Hills and the sea, and inferior valleys formed by subordinate hills in the ranges, and finally the plains of Vagad. The plain running in from the coast towards the Dora range is the most extensive, and is often twenty and even thirty miles broad, interspersed occasionally with detached hills. Close to the sea-beach is a high bank of sand, which extends from the western end of the Province to the entrance of the Gulf of Cutch, and is called by the natives "Chigo." For the rest, the general appearance of Cutch which is arid and sandy in the extreme, is very often diversified in the neighbourhood of its towns and villages by patches of cultivation. Of grains the following are cultivated in Cutch: *Pennisetum typhoideum*, Rich. (Bajri or common Millet). It forms one of the staple crops and when sown in middling soils it grows best where the land is slightly salt. Though generally grown by itself, it is also sown with *Phaseolus mungo*, L. (Mag.) and *Phaseolus aconitifolius*, Jacq. (Korad) in Abdasa and Vagad. On the whole it flourishes best as a garden crop. *Andropogon sorghum*, Brote. (Juvar or Great Millet) does best on deeply cultivated rich clay and is rarely watered. Five chief varieties are grown in Cutch: Juvar and Puchar, sown in June or July soon after Millet and Cotton; Gundali, sown before the beginning of the cold weather or towards the end of August; Chastio, sown about the end of February and grown by irrigation; Ratad, sown in July and August as a dry crop, or in the hot season as a watered crop. *Triticum vulgare*, Vill. (Wheat) is chiefly irrigated. Only in some parts of Vagad that are liable to flooding, unwatered wheat is grown. It generally ripens in February. *Hordeum vulgare*, L. *var. hexastichon*, Aitchis. (Jav or Barley) is grown by irrigation and reaped in January. In the south alluvial plain and in the plain north-west of Bhuj about Dhinodhar they grow small quantities of *Eleusine coracana*, Gaertn. (Nagli) and *Panicum crus-galli*, L. *var. frumentaceum* (Banti) as cold weather crops. *Panicum miliaceum*, L. is rare. *Saccharum officinarum*, L. (Sugar cane) may be mentioned in this place on account of its position in the natural system of classification. It is grown in small quantities, especially in Central Cutch to the north-west, south-east and south-west of Bhuj, and about Anjar and Mundra. The Pulses are not well represented. In the most sandy parts we find *Phaseolus aconitifolius*, Jacq. (Karad). It is mostly sown by itself, but sometimes mixed with *Cyamopsis psoralioides*, DC. (Guvar) which grows best in sandy loam. The same kind of soil is very suitable to *Phaseolus mungo*, L. (Mag). *Cicer arietinum*, L. is very little grown as a cold weather crop. *Ricinus communis*. L. is common all over the Province, but chiefly grown as an early crop in Vagad, Kanthi, and eastern Abdasa. It is foten sown together with Cotton. *Sesamum indicum* DC., and *Guizotia abyssinica*, Cass. are grown in the rainy season, either by self, as in Vagad and parts of Abdasa, or together with Cotton and Millet in other places. *Brassica campestris*. L. *var. napus* (Rapeseed) is a cold weather crop, and grows either by itself or together with wheat. In eastern Abdasa, Kanthi, and Vagad *Gossypium herbaceum*, L. is extensively grown in clay soil. It is picked twice or thrice towards the end of February, in March or April. The common Indian vegetables are cultivated in plenty, and the soil and climate have proved exceedingly favourable to European vegetables. The latter require only constant irrigation during the hot season to preserve them in luxuriance. The following are found in various parts of Cutch: *Hibiscus esculentus*, L.; *Pisum sativum*, L.; *Dolichos lablab*, L; *Cajanus indicus*, Spreng.; *Phaseolus vulgaris*, L.; *Moringa pterygosperma*, Gaertn.; *Cucumis sativus*, L.; *Cucumis melo*, L.; *Luffa ægyptiaca*, Mill.; *Momordica charantia*, L.; *Trichosanthes anguina*, L.; *Lagenaria vulgaris*, Ser; *Citrullus vulgaris*, Schrad.; *Cucurbita moschata*, Duchesne; *Cucurbita maxima*, Duchesne; *Cucurbita pepo*, DC. The Melons, generally, are reckoned superior to those of any neighbouring country. They grow in the dry beds of rivers where their roots are in a stream of water a few inches below the surface. Their leaves and fruits being exposed to the double effect of a burning sun upon a scorching sand, the fruit is brought to the greatest perfection. The Melon is ripe in April, May and June. Other vegetables are: *Daucus carota*, L. (Carrot); *Apium graveolens*, L. (Celery); *Solanum melongena*, L. (Brinjal); *Lycopersicum esculentum*, Miller (Tomato); *Brassica oleracea*, L. with many varieties; *Raphanus sativus*, L.; *Allium cepa*, L.; *Allium sativum*, L. Besides, we find the following plants cultivated: *Nicotiana tabacum*, L. (Tobacco); *Solanum tuberosum*, L. (Potato); *Capsicum frutescens*, L. (Chillis). Of fruits *Mangifera indica*, L. (Mango) and *Psidium guyava*, L. (Guava) are largely grown by the help of water. In some parts of the sandy water-bearing yellowish-brown soil we find *Phœnix sylvestris*, Roxb

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[1] cf. Bombay Gazetteer, Vol. V.

(Date Palm). Though being inferior to those from Arabia, Persia, and Sind, the Cutch Date is better than any other grown in Western India. *Cocos nucifera*, L. (Cocoanut) is cultivated in small quantities along the coast. *Vitis vinifera*, L. produces well-flavoured grapes. Other fruit trees are: *Punica granatum*, L. (Pomegranate); *Carica papaya*, L. (Papaya); *Musa sapientum*, L. (Plaintain); *Citrus medica*, L. (Citron); *C. medica*, L., *var. limetta* (Sweet Lime); *C. medica*, L., *var. acida* (Sour Lime); *C. medica*, L., *var. limonum* (Lemon); *Citrus aurantium*, L. (Orange); *Citrus decumana* Murr. (Pummelo); *Feronia elephantum*, Carr. (Elephant or Wood Apple); *Anona squamosa*, L. (Custard Apple); *A. reticulata*, L. (Ramphal).

The catalogue given above cannot be considered to be complete. It contains those species only that have been collected on our tour from Rohar, on the Gulf of Cutch, to Anjar, Bhuj, and across the Banni, to Pacham Island in the Grand Rann. Our journey, therefore, forms, so to say, a cross-section of the whole Province of Cutch, and as the physical and climatic features of the different parts of Cutch do not vary very much, I think we are right in concluding that this cross-section will give a fair idea of the whole flora. Only a few plants have been added to our list on the authority of Col. Palin; but we have every reason to believe that they occur in the same region which we examined ourselves.

The following remarks apply only to the indigenous plants of which our catalogue contains 345 species. These belong to 74 Natural Orders. The dominant Orders (*viz.*, those represented by the greatest number of species) of the Cutch flora are, roughly taken, the same as those of Hooker's Indus Plain Province. The *Leguminosæ* stand first with 67 species; then there follow the *Gramineæ* with 35, the *Malvaceæ* with 24, the *Compositæ* with 22, the *Cyperaceæ* with 17, the *Convolvulaceæ* with 17, the *Cucurbitaceæ* with 15, the *Amarantaceæ* with 13, the *Capparidaceæ* with 12, the *Acanthaceæ*, *Euphorbiaceæ*, and *Solanaceæ* with 11 species. It is very probable that a more thorough exploration of the country will change the rank of some Orders. With regard to the *Gramineæ*, *e.g.*, we feel pretty sure that they outnumber the *Leguminosæ*. Though, on the whole, most of the plants seem to be out in December, it is just the grasses that do not present themselves in such a condition at that time as to furnish sufficient material for their identification. Of the 345 indigenous plants about 30 only are trees, 95 shrubs and undershrubs; all the rest are herbs, mostly perennials. Almost all the plants have a wide geographical distribution with regard to the Indian as well as to the extra-Indian region. No endemic species has been found as yet. Cutch has over 200 species in common with Sind and about 160 with Gujarat. Of the latter about 70 do not occur in Sind, whilst of the former over 80 have not been found in Gujarat. If we consider that Cutch is a country with a long dry season, that the soil is mostly sandy or rocky, that salt is present in the soil not only along the sea shore and in the vicinity of the Great Rann, but more or less all over the country, we shall find it quite natural that most of the plants of Cutch exhibit a remarkable general similarity and agree in having a lower rate of transpiration than plants living in places where plenty of water is available; in short that the vegetation shows a distinct xerophytic character. Nearly all the structural features by which transpiration is reduced may be observed in the flora of Cutch: A thick cuticle upon the epidermis of the leaves, reduction of the number of stomata, depression of the stomata, a thick covering of hairs, reduction of the transpiring surface, formation of aqueous tissue, etc. In the following we shall examine a number of plants in which the xerophytic character is best expressed, indicating briefly the special contrivances by which reduction of transpiration is obtained.

In *Tinospora cordifolia* a corky bark is formed over the woody parts of the plant and, thus, transpiration confined to the younger parts and the leaves.

Cocculus villosus has the younger parts densely villous, also the upper and lower surface of the leaves and the petioles. *Cocculus leæba* shows similar formations to those of *Tinospora cordifolia*. *Farsetia jacquemontii*, a rigid shrub, is covered all over with appressed hairs, which, like a thick felt, reduce excessive transpiration. The Order *Capparidaceæ* shows a great variety of adaptations to a dry climate. *Cleome monophylla* is covered with pubescence and even the capsules are clothed with short stout hairs. *Cleome stocksiana* is partly protected by having fleshy leaves which store up a considerable quantity of water.

In *Cleome brachycarpa* the younger stems are covered with glandular hairs: also the petals are glandular-pubescent as well as the capsules. Those glands secrete an ethereal oil which resembles very much that of the rue. It is just the vapours of that oil which acts protective against too profuse transpiration; for it is a well known fact that air laden with vapours of an ethereal oil is much less permeable to radiating heat than pure air. In this way a plant, surrounded by a layer of vapours of an ethereal oil, will be protected at day-time against overheating and consequently against excessive transpiration, and at night against too great a cooling down.

The stems and branches of *Gynandropsis pentaphylla* are covered with white spreading hairs and the leaves are pubescent on both sides, whilst the sepals and the ovary are clothed with glandular hairs.

The young stems and branches, including the leaves of *Capparis spinosa* are covered with a grayish-white layer of wax which just allows the green colour to be slightly visible. This contrivance greatly reduces cuticular transpiration. The same effect is produced by the orange colour of the stipules, which in this plant assume the form of two hooked thorns.

The reduction of the transpiring surface is well shown in *Capparis aphylla.* The older branches are quite destitute of leaves, and the younger shoots bear exceedingly small and spinous-pointed leaves. Also in this case, the stipular thorns are not green, but orange-yellow. The young parts of *Capparis horrida* are protected by a rufous tomentum. *Polygala erioptera* has narrow linear leaves, whilst specimens of the same species, but growing in less dry parts of the Presidency have usually oblong-ovate leaves. In *Polycarpæa corymbosa* the young branches and the pedicels are hoary-pubescent, the leaves narrow linear. The species of *Portulaca* are protected in various ways: The stems of *P. oleracea* are reddish, the leaves fleshy with reddish margins. We find fleshy leaves also in *Portulaca quadrifida* and *P. tuberosa*: the stipules form a ring of silvery hairs in the former, and a ring of brownish ones in the latter.

Tamarix dioica and *ericoides* have got minute scale-like leaves. Both make use of the hygro copic salts that collect on the surface of the plant. At times of drought they absorb the moisture which is contained in the atmosphere in the form of vapours. Thus it happens that very often at night or in the early morning the green parts of the plant are covered with dew, whilst all the other plants in the neighbourhood are quite dry. The white crust that is seen at day-time on the green branches and leaves consists chiefly of chloride of sodium and calcium carbonate with some other saline substances.

Bergia odorata shows the tendency to crowd the leaves into fascicles. It is evident that by this means the leaves cover and protect each other and are, thus, less exposed to the heating influence of the sun. *Sida spinosa* and *rhombifolia, var. retusa*, look quite gray from very small stellate hairs. Still better protected is *Abutilon graveolens* which, besides having long spreading hairs, is covered with a sticky coat of short hairs. Of *Grewia villosa*, which is usually found in the dry parts of the Presidency, the branches are grey puberulous, the upper surface of the leaves rough with stellate hairs, the lower velvety, the petioles villous and the stipules hairy, the flower-buds, sepals, and ovary covered with pilose hairs.

Tribulus terrestris and *T. alatus* belong both to the desert flora. Besides being protected by silky villous hairs they perform some special movements by which the plant-surface exposed to insolation is greatly reduced. The leaves are abruptly pinnate. Now, when the heat is rising at noon or in the afternoon, the leaflets begin to turn round their own axis and, at the same time, upwards round the common rhachis, till they are lying in one vertical plain with their upper sides touching each other.

Zigophyllum simplex and *Z. coccineum* differ from the above mentioned plants by the distinct succulence of their leaves. In both species they are cylindric, in *Z. simplex* sessile and in *Z. coccineum* bifoliate on a stout fleshy petiole. In the centre there is a thin-walled water-tissue occupying about $\frac{2}{3}$ of the whole diameter in the former, and about $\frac{1}{2}$ in the latter. At the same time, the stomata are depressed. The young branches in *Z. coccineum* are, besides, covered with a white powdery tomentum. The leaves of *Fagonia cretica* are thick, approaching the type of succulent plants. The outer walls of the polygonal cells of the epidermis are very much thickened. *Lotus garcini* is a small undershrub that grows in sandy soil. Its branches are covered with grey silky hairs ; the leaflets are extremely small and fleshy, both sides are clothed with grey hairs. Many species of *Indigofera* and *Tephrosia* are similarly protected. *Alhagi camelorum* is a much-branched rigid shrub armed with axillary spines which produce the flowers. The leaves are not of great importance, being very small and of short duration. Their function is performed by the green tissue of the branches and thorns which have their stomata in pits at right angles to the long axis. *Acacia eburnea*, indigenous in the dry parts of India, has the young branches purplish-brown; the leaves are very small and the long stipular spines ivory-white. *Echinops echinatus*, a thistle-like herb, is clothed with a white cottony pubescence. The deeply pinnatifid leaves are spinescent, the spines very often reaching one inch; the involucres are surrounded by strong white bristles and the intermediate bracts are usually produced into sharp spines. Of the *Asclepiadaceæ* the following contain a milky juice: *Periploca aphylla*, *Calotropis procera*, *Oxystelma esculentum*, *Dæmia extensa*, *Sarcostemma brevistigma*. I have not been able to ascertain whether the laticiferous tissue, besides being a reservoir of waste-products, contains also plastic substances. The fact that so many plants growing in dry localities develop this tissue makes it very probable that part of the latex is reserved for times of scarcity. *Periploca aphylla* is an erect branched shrub and mostly without any leaves; but when these are present they are extremely small and thick. *Calotropis procera* grows much higher in Cutch than I have ever seen it on the Deccan. The woody parts become quite corky, whilst the young branches and leaves are covered with a cottony tomentum. *Sarcostemma brevistigma* is a twining jointed shrub without leaves; transpiration is confined to the green pendulous branches. *Leptadenia spartium* is mostly leafless; leaves are seen sometimes on young shoots.

Cressa cretica, which is a common undershrub on cultivated fields and blown sand, can be recognized by the great number of very small leaves that are covered all over with a whitish crust of a hygroscopic salt. This is secreted in solution by glandular hairs that are to be found in depressions on both sides of the leaves. It is not very probable that the water supplied by the absorbing action of the salt is sufficient in times of drought, because the leaves are very delicate, the outer walls of the epidermal cells thin and the stomata not depressed at all. It seems that the rhizome which descends very deep into the substratum furnishes the necessary moisture.

Breweria latifolia, *Convolvulus rottlerianus*, and *C. microphyllus* are small undershrubs confined to the dry parts of the Presidency. A dense felt of silky hairs and strong outer walls of the epidermis seem to be their chief protection. The transpiring surface of *Solanum xanthocarpum* is considerably reduced by the formation of numerous yellow prickles on the branches and on the midrib and nerves of the leaves. *Solanum indicum* and *S. trilobatum* are similarly armed. *Blepharis sindica* is protected in various ways: the stem is mostly very short, often scarcely visible; the branches are ash-grey and covered with short hairs; the leaves are small linear and sessile, rough with stiff hairs, and have the margins bent back; at the base of the leaves there are sometimes some small spinous teeth; the bracts are hairy on both sides with a spinous point, the upper part is armed with recurved sharp spines: the bracteoles are hairy and ciliate; the outer and inner side of the calyx are softly hairy, the 3 midnerves of the larger calyx-segment are produced into 3 bristly teeth. In *Salvia ægyptiaca, var. pumila*, we find that the vascular bundles of the main-nerves are surrounded by water-tissue which unites the epidermis of the upper side of the leave with that of the lower one. As to *Ærua javanica* there is scarcely any doubt that the thick woolly felt covering almost all the parts of the plant, is protective in function. In *Salicornia brachiata*, a jointed branched shrub, transpiration is entirely confined to the green branches, there being only scaly bracts and no leaves at all. *Suæda fruticosa* and *S. nudiflora*, which usually grow in saline places, have fleshy leaves. A transverse section shows that the greatest part is occupied by water-tissue.

Before concluding this paper I should like to make a few remarks on the flora of the Grand Rann, as it has been suggested that a more accurate knowledge of the vegetation of that part of the country might help to decide the question as to the origin of the Rann. I cannot give a better description of that interesting piece of land than the one given by Captain Grant[1] in his

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[1] Memoir to illustrate a Geological Map of Cutch, by C. W. Grant, Esq., Captain, Bombay Engineers (In the transaccions of the Geological Society of London, Vol. V, p. 289. (II) series).

"Geology of Cutch." "This tract containing an area of upwards of 7.000 square miles, exclusive of the space occupied by the Bunnee, and the islands of Pacham, Khureer, etc., is perhaps, unparalleled in any known part of the globe, as it may be said to be placed on a level between land and water. It is dry during the greater part of the year, when its surface consists of a sandy flat, totally devoid of vegetation; but, perhaps, on account of its saline nature, always sufficiently moist to prevent its particles being drifted. During the prevalence of the south-west winds, however, so much water is blown up its eastern inlet by the Gulf of Cutch, and, at its western extremity, by the eastern branch of the Indus, as to cover its whole surface: augmented by the freshes, which, at the same time, come down the Loonee and Bunass Rivers, and the numerous small streams which intersect the northern coast of Cutch. At those seasons the Rann has all the appearance of a sea, and is passable only on camels, and in some seasons, with difficulty." At wide intervals we find small patches of coarse rush-like grass, elevated a couple of feet above the general level. They seem to have been flat banks formed by wave action or preserved by vegetation. To the south-west of Pacham Island almost parallel to the main land stretches a low lying tract, called the Banni. It rises a little higher than the remainder of the Rann and is about 65 miles long and from ten to sixteen broad. In some places, especially near water, it is thickly, but for the most part scantily covered with coarse grass. The Babul (*Acacia arabica*) is the only tree that breaks the monotony of the country. It does not reach the height it attains on the mainland, is usually isolated and rarely found gregarious. Of other plants we noticed only *Solanum xanthocarpum* and some species of *Crotalaria* and *Heliotropium*, growing exclusively near the bee-hive-shaped grass huts of the herdsmen.

There is no definite boundary between the Banni and the Rann. South of Pacham Island the Rann can only be recognized by a narrow belt devoid of trees. Pacham Island itself is situated in the centre of the Rann, stretching about 15 miles from north to south and 10 from east to west. It is crossed by two somewhat east and westerly chains of hills: the one to the north is called the Kala Doongur (Black hill) and the one to the south Gora Doongur (White hill). In the former we find the most lofty elevation of

Cutch, the Pacham Pir which rises directly from the Rann to a height of 1 437 feet. A most extensive view can be obtained from the summit of this mountain. Beyond a waste of salt and water the Parkur hills are visible, and to the south and south-east appear the dark surface of the Banni and the Cutch hills. The island is surrounded by a margin of low ground of no great width, but narrowest where the mountains rise most steeply from the Rann on the northern side. Sheets of hæmatitic laterite overlap and wrap round the jurassics on the west and south of the low ground, sometimes associated with earthy rocks and beds resembling volcanic ash. Higher up the beds consist of fine white and light coloured silicious sandstone with calcareous bands and sandy slightly ferruginous purple beds ; pale flaggy sandstones also occur.

This is not the place to enter into a discussion as regards the arguments of geologists or an examination of the traditions of the natives to the effect that the Rann was once submerged. D. Oldham (Memoirs of the Geological Survey of India, Vol. IX, p. 28) came to the following conclusions : "To whatever causes the great plains of Sind and the coast plains of Western India are due, that of the Rann may also be ascribed. Its origin must be traced further back than the formation of the deltas of the Indus and other neighbouring rivers, because something in the nature of a plain or open ground was necessary to receive such deposits. This open ground was here more hilly than to the north in all probability, for the high islands which rise from the Rann are evidently but the modified summits of an older surface ; and the silting-up of the sea-inlet which it formed was only the natural result of its land-locked capacity to retain the materials brought down by rivers. The Bunnee is a bank formed most probably by the discharge of the Kutch streams ; and the slight elevation *en masse* which subjected the old shore-deposits to denudation has aided the tendency of the basin to retain transported sediment, which must accumulate yearly under present circumstances until the rivers that convey it find their way across the tract through channels traversing an alluvial plain."

So far geology on the origin of the Rann. Are we able from the condition and characters of the present flora of Pacham Island to derive any argument for or against the views expressed by geologists? If the island contained no endemic species, but were characterized by species that do not occur in the countries immediately bordering on the Rann of Cutch, we would be obliged to admit that at one time the island formed part of a big continent, that, afterwards, its immediate surroundings were submerged, and that what is now Sind, Rajputana, Guzerat, and Cutch, was changed entirely by some cause or other. If endemic species were found amongst the members of the flora, we would be right in concluding that Pacham was not recently detached from a continent, but that, from the beginning, it was a true oceanic island, and that, after a long interval, the land began to rise and to form round Pacham Isle. Neither of the two conditions is fulfilled with regard to the biggest of the Rann islands. We did not notice a single species on Pacham, which we had not previously seen on the mainland. The fact that the whole aspect of the Pacham flora is quite different from that of any other part of Cutch examined by us is not due to specific differences in the composition of the vegetation but to differences in the combination and development of its members, in consequence of the special climatic and edaphic conditions prevailing on the island. Everybody, after crossing the grassy plain of the Banni and the monotonous waste of the Rann, will be astonished to find, on a sudden, a comparatively rich vegetation. Fine shady trees greet the traveller in the lowlying belt of the island, and dense thickets of shrubs and climbers cover those parts that are not under cultivation. The prevalence of woody plants is the most striking feature of the flora. The mountain slopes look, from a distance, as if covered with dense forest, but, on closer inspection, the trees are losing a good deal of their size and beauty, and the whole forest now assumes the appearance of a more or less dense thicket of stunted trees and shrubs of a distinctly xerophytic character. The herbaceous vegetation is very scanty; only in crevices, where some soil has accumulated, nature has succeeded in producing a few poor species belonging chiefly to the *Gramineæ*, *Compositæ*, *Labiatæ*, and *Leguminosæ*.

It is evident that a flora with so few characteristic peculiarities in its aspect and with none as regards its composition, being merely a repetition of the vegetation of the mainland, cannot give any clue as to the origin of the Rann. We can easily explain how, under conditions similar to those of the present day, the whole flora of

Pacham Island may have developed in the course of a few centuries; we have only to remember the different methods that are employed by plants for the purpose of seed-dispersal. If this be once admitted it is difficult to see how we shall measure geological times by the moments of a flora that may possibly be of yesterday.

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, No. 2.

BY

J. C. KERSHAW & G. W. KIRKALDY.

(*With Plate B.*)

This memoir deals with *Antestia anchorago* (Thunberg), a somewhat widely distributed Cimicid of the subfamily Pentatominæ. It occurs in Sikkim, but has not been recorded from more Southern India; it occurs also in Assam, Burma, Tenasserim, the Malay Peninsula and Southern China, Mr. Kershaw having found it in Macao. Mr. Distant (1902, Faun. Ind. Rh. I., 183) notes it from Sumatra and Java, but these records apply to the closely allied Indo-Malayan *A. ellenriederi* Breddin, which has not been discovered on the mainland.[*]

The genus *Antestia* contains nearly 40 species, mostly conspicuously coloured, distributed over the Australasian, Oriental, and Ethiopian Regions. *A. variegatus* (Thunberg) is a sometimes serious coffee pest wherever that plant is cultivated in the Southern half of the African Continent; its metamorphoses have been partially described and figured by Zimmermann.[†] The widely distributed *A. partita* (Walker) and *A. cruciata* (Fabr.) are also known as coffee pests, the former also feeding on *Fraximus* and *Morinda*. *A. anchorago* feeds in Macao on *Pavetta indica*, one of the Rubiaceæ.

Among some of their allies, which are similarly conspicuously coloured, are the Palaearctic *Eurydema* spp., the American *Murganta histrionica* and the Ethiopian *Bagrada hilaris*, all feeders on, and often pests of, Cruciferæ, while the Indian *Apines concinna* (Dallas) attacks winter crops in the North-West Provinces.

Antestia anchorago.

The female lays a batch of (usually) 8—12 eggs, deposited contiguously, on the underside, occasionally on the upperside, of the leaf of *Pavetta indica* L. The eggs are barrel-shaped, smooth, with a ring of minute processes round the anterior end, within which the operculum fits. There is no hinge, the operculum merely lying on the rest of the egg and kept fast by the ring of processes.[‡] At deposition they are greenish-ochreous, deepening to dull-ochreous later (Pl. B. fig. 8.). They were laid on November 17th, 1907, hatching on the 24th November; whilst actually emerging, the nymphs lack any black markings on the thorax, and those on the abdomen are pale fuscous; the eyes are dark red (fig. 1). In about two hours and a half, the markings appear as in fig. 2. The young nymphs usually cluster in a ring round the empty shells, all the heads inwards. There are 5 nymphal instars, the first moult occurring about five days after hatching; the second in about another 10 days, the third in about 30 days, and the fourth about thirty. In the dry season, the nymphal stages must last altogether over three months; probably a month or less in the wet. In the younger instars the abdomen is very convex dorsally, the underside flat and wholly black.

---

[*] *A. ellenriederi* is graminivorous and sometimes a pest to rice.

[†] 1903, Ber Land.—und Fortwirtsch. Deutsch Ost Afrika I. 366, Pl. iv., figs. 12—17.

[‡] This seems to be a common form of egg in Cimicidæ.

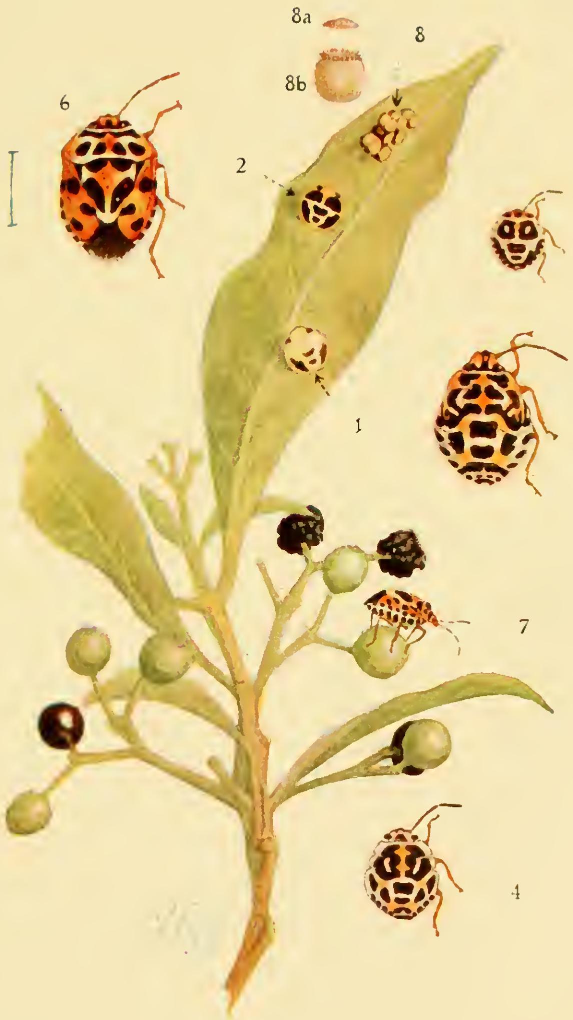
It is rare to find a shrub of *Pavetta indica* without this bug, and the leaves are conspicuously marked with the white punctures left by their setæ. The bugs suck both leaves and berries of the plant.

EXPLANATION OF PLATE B.

1. Nymph of first instar just hatching out.
2. The same about 2½ hours later. After the first moult, the small white spot appears faintly in the two black thoracio areas: otherwise no material change.
3. Third instar.
4. Fourth instar.
5. Fifth instar.
6. Adult. The head is foreshortened, being declivous.
7. The same sucking an unripe *Pavetta* berry.
8. A cluster of ova.

8*a*. The operculum, natural size.

8*b*. Natural size, the operculum lifted off.


8a
8
8b
6
2
3
5
1
7
4

ORIENTAL HEMIPTERA (No. 2).
Antestia anchorago (Thunberg).

LIST OF FERNS FOUND AT AND AROUND MUSSOORIE, 1908.

BY

JAMES MARTEN.

Nat. Ord.—FILICES.

I.—DAVALLIEÆ.

1. *Leucostegia pulchra.*	Very common here, growing on trees and rocks, starts growing with the incoming monsoon and withers away in October.
2. *Leucostegia immersa.*	Occurs, but is not common. Specimens procured in the Mossy Falls stream during the rains at about 4,000 feet elevation.
3. *Cystopteris setosa.*	In frost above Jabar-Khet, elevation about 9,000 feet

II.—PTERIDEÆ.

(*a*) ADIANTUM.

1. *Adiantum lunulatum.*	Good specimens collected below Jheri-Pani, elevation about 3,500 feet. It is very common throughout the Dun as an annual.
2. *Adiantum caudatum.*	Good specimens collected below Jheri-Pani, elevation about 3,500 feet. It is very common throughout the Dun as an annual, but is evergreen, under favourable conditions good for covering rockwork.
3. *Adiantum capillus veneris.*	Common in damp places, growing on rocks which remain moist with water charged with lime, is seen to perfection at the Robber's Cave and at Sans-dhara, takes kindly to cultivation, not found much over 7,000 feet. Vernacular name "hans-raj."
4. *Adiantum venustum.*	A higher elevation Fern, good specimens collected on the north slope of Camel's Back and on Pari Tiba or as it is known here Burnt Hill.
5. *Adiantum pedatum.*	This pretty Fern is in my cultivation but is not found in these hills. My specimens were collected in Pangi (Chamba) above 10,000 feet, where also I collected *A. capillus veneris*, var. *Wattii*.

(*b*) CHEILANTHES.

1. *Cheilanthes farinosa.*	This is a very common Fern here and several types of it are noticeable. It is known as the Silver Fern and grows during the rains only.

(c) ONYCHIUM.

1. *Onychium auratum.*	This beautiful Fern is found at Sans-dhara and at Rajpur. I have tried repeatedly to grow it, but with no marked success.
2. *Onychium japonicum.*	Both varieties *intermedia* and *multisecta* are found here and I have both kinds growing in my verandah. Commonly known as the Carrot Fern.

(d) PTERIS.

1. *Pteris cretica.*	Is very common, it is a perennial hardy Fern, makes handsome specimens for verandah culture, found between 5,000 feet and 8,000 feet.
2. *Pteris semipinnata.*	Does not occur here. The specimens in my collection I took in the Garo Hills (Assam). I brought live plants but these did not survive long in cultivation. Found at 900 feet in shade.
3. *Pteris quadriaurita.*	Is common and is green throughout the year, found from 2,000 feet to 7,500 feet elevation.
4. *Pteris aquilina.*	The bracken is found here as also throughout the Himalayas—in Bushahr and Chamba, the natives use this Fern as a bed to their flat mud roofs as it does not rot readily, it is also used as bedding in their cattle sheds during the winter months.
5. *Pteris longifolia.*	Is a very common Fern in the Dun and ascends into these hills to about 5,000 feet, it is a hardy Fern, and good Fern for verandah culture.

(e) CERATOPTERIS.

Ceratopteris Thalictroides.	Is common in damp localities in the Dun at 2,000 feet often growing quite submerged. Growing in rice fields in the Raipur District, Central Provinces.

III.—BLECHNEÆ.

(a) *Blechnum orientale.*	Found at head of the Swarna Rau, Western Dun about 4,000 feet, makes a good pot-plant for verandah culture.
(b) *Woodwardia radicans.*	This beautiful Fern is common. I have collected fronds five feet and more long from favourable localities, a very hardy Fern which lends itself readily to cultivation.

IV.—ASPLENIEÆ.

(*a*) ASPLENIUM ALTERNANS.	Is the commonest of this tribe up here, growing out of old walls, embankments and rocks, but is seen during the rains only and ranges here from about 3,000 to 7,500 feet.
1. *Asplenium laciniatum.*	Occurs, but so far I have not found it in any quantity ; my specimens were procured at 7,000 feet.
2. *Asplenium varians.*	Is plentiful, growing on old walls, rocks and banks ; this pretty little fern withers at the end of the rains but I have no doubt that under cultivation and with a little care it could be induced to remain green throughout the year.
3. *Asplenium fontanum.*	Found growing in a hole on the bank of a perennial stream on the cart road, about 5,000 feet.
4. *Asplenium tenuifolium.*	At 8,000 feet, north slope of Landaur.
(*b*) ATHYRIUM FALCATUM.	Common everywhere, at about 7,000 feet.
(*c*) DISPLAZIUM POLYPODIOIDES.	In streams and near water, about 4,000 feet. The tender-tops are cooked and eaten as a vegetable.
1. *Diplazium umbrosum.*	Common throughout the Dun in damp localities, but does not, so far as I know, ascend higher.

V.—ASPIDIEÆ.

(*a*) POLYSTICHUM AURICULATUM.	Found at base of Pari Tiba or Burnt Hill, about 4,000 feet, growing out of a precipice.
1. *Polystichum aculeatum,* var. *rufo-barbatum and* var. *angulare.*	Common at 7,000 feet.
(*b*) CYRTOMIUM FALCATUM. var. *caryotideum.*	Is found here on the north slopes, under shade, about 7,000 feet, this makes a good verandah plant.
(*c*) ASPIDIUM CICUTARIUM.	At Rajpur ascending into the higher hills up to about 4,500 feet, grows well in cultivation.
(*d*) LASTREA FILIX-MAS var. COCHLEATA.	Found above Rajpur and stream near Bhatta village at about 4,000 feet.
1. *Lastrea spectabilis.*	Near Jabar-Khet at 7,000 feet.

2. *Lastrea crenata.*	This handsome Fern is common, growing out of precipices and rocks on south face of the hills between 3,000 and 7,000 feet; here it dies down during the cold months; but lower down just above Rajpur, it grows throughout the year, so far I have failed to grow it.
(e) NEPHRODIUM MOLLE.	Very common throughout the Dun and ascending up the larger streams into the higher hills; it is a moisture loving Fern. Grows well in cultivation.
1. *Nephrodium* var.	Found on Burnt Hill near water; also on cart road below Vincent's Hill, not yet identified.

VI.—POLYPODIEÆ.

(*a*) PHEGOPTERIS DISTANTS.	Landaur at about 8,000 feet.
1. *Phegopteris* var.	Found beyond Jabar-Khet on the Tehri Road at 7,000 feet, not yet identified.
(*b*) GONIOPTERIS PROLIFERA.	Very common in the Dun and ascending along all perennial streams into the higher hills to about 4,000 feet; it creeps and roots at the apex and thus forms dense masses where it grows like *Nephrodium molle*, it is a moisture loving Fern.
(*c*) GONIOPHLEBIUM AMÆNUM.	Common, growing on trees and rocks during the rains between 4,000 and 8,000 feet.
1. *Goniophlebium subamœnum.*	Common, growing on trees and rocks during the rains between 4,000 and 8,000 feet.
2. *Goniophlebium lachnopous.*	Found at 7,000 feet.
3. *Goinophlebium argutum.*	At Jabar-Khet, 7,500 feet.
(*d*) NIPHOBOLUS STIGMOSUS.	Common on trees in Dehra Dun and on trees and rocks at Mussoorie. It dies down in the cold months.
(*e*) DRYNARIA MOLLIS.	I have not found this Fern at Mussoorie, but have specimens collected about Chakráta in Jaonsár.
1. *Drynaria coronans.*	Fronds up to 6 feet long of this beautiful Fern were gathered by me in the Garo Hills (Assam) at 1,500 feet elevation.

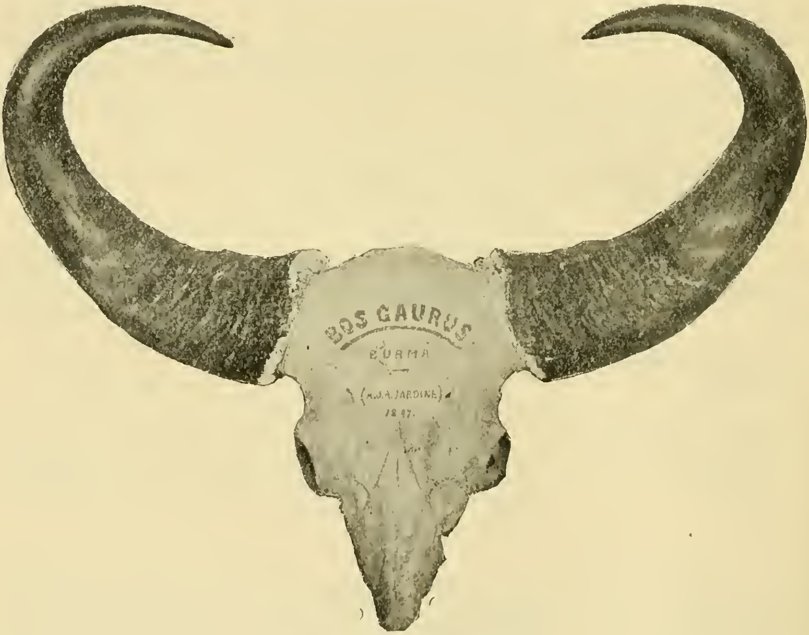
(j) PLEOPELTIS LINEARIS.	Found growing on trees and rocks at Mussoorie.
1. *Pleopeltis longifolia.*	Found growing on trees and rocks at Mussoorie.
2. *Pleopeltis simplex.*	Is very common, growing on trees and rocks; all die down after the rains cease.
3. *Pleopeltis membranacea.*	Found growing on rocks but is not common; it likewise dies down after the rains but in cultivation lives on throughout the year.
4. *Pleopeltis juglandifolia.*	Landaur and Jabar-Khet, about 7,500 feet. Grows well in cultivation and forms beautiful specimens.
5. *Pleopeltis malacodon.*	From Jabar-Khet, about 7,000 feet.
VII.—GRAMMITIDEÆ. (a) SYNGRAMME FRAXINEA.	Found on the Camels Back, about 7,000 feet, elsewhere in Mussoorie at much lower elevations.
1. *Syngramme vestita.*	On the Tehri Road at about 7,000 feet; not common.
(b) SELLIGUEA ELIPTICA.	Found at the head of the Swarna Rau (Western Dun) at 4,000 feet.
(c) LOXOGRAMME INVOLUTA.	At Jheri Pani, elevation 5,000 feet.
VIII.—SCHIZÆACEÆ. (a) LYGODIUM FLEXUOSUM.	This climbing Fern is fairly common in the Dun and grows well in cultivation. Does not appear to ascend into these hills.
IX.—OPHIOGLOSSACEÆ. (a) OPHIOGLOSSUM RETICULATUM.	Common, growing on gravel paths in gardens at Dehra Dun. I have not met with it higher up, but the fact that it is found in gardens at Dehra would point to its being carried by the canal water from somewhere above Rajpur.
(b) BOTRYCHIUM VIGINIANUM, var. LANUGINOSUM.	This handsome Fern grows here during the rains only between 5,000 and 7,000 feet.

MEASUREMENTS OF SOME OF THE HORNS IN THE COLLECTION OF THE BOMBAY NATURAL HISTORY SOCIETY.

BY

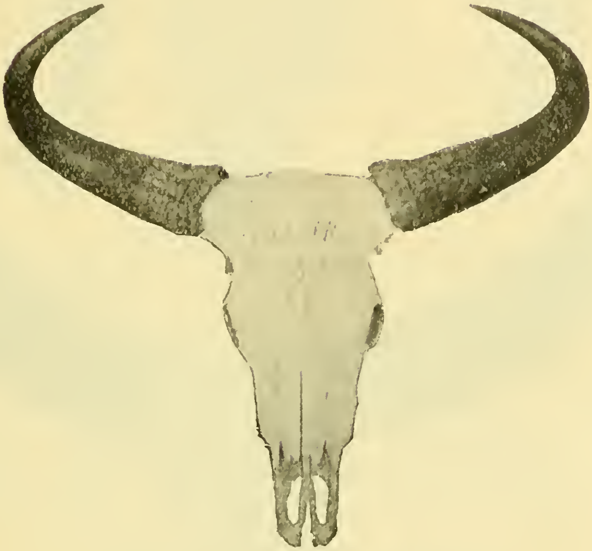
N. B. Kinnear.

In 1885 the Society purchased a collection of heads from M. Dauvergne which, according to the old minute book, consisted of "4 *Capra sibirica*, 4 *Capra megaceros*, 3 *Ovis vignei*, 6 *Ovis natura*, 2 *Ovis hodgsoni*, 1 *Nemorhædus bubalina*, 6 *Pantholops hodgsoni*, 3 *Cervus cashmirianus* and 1 *Cervulus aureus*." A few months later in the same year fifteen skulls and horns were presented by Mr. J. Shillingford of Purneah and among them were the skulls of an Indian Elephant and an Indian Rhinoceros and horns of Buffalo, Swamp, Hog and Spotted Deer. These two collections of horns, though they are not all mentioned in the list, only the best ones being given, were the foundation of the Society's collection. Since 1885 many members and others have presented specimens, the principal benefactors being Vet. Major G. Evans, Messrs. T. J. Campbell, T. J Spooner, T. R. Bell, Col. C. W. Ravenshaw, and the late Mr N. S. Symons. Unfortunately there is no history as to where many of the heads have come from or by whom they were presented.



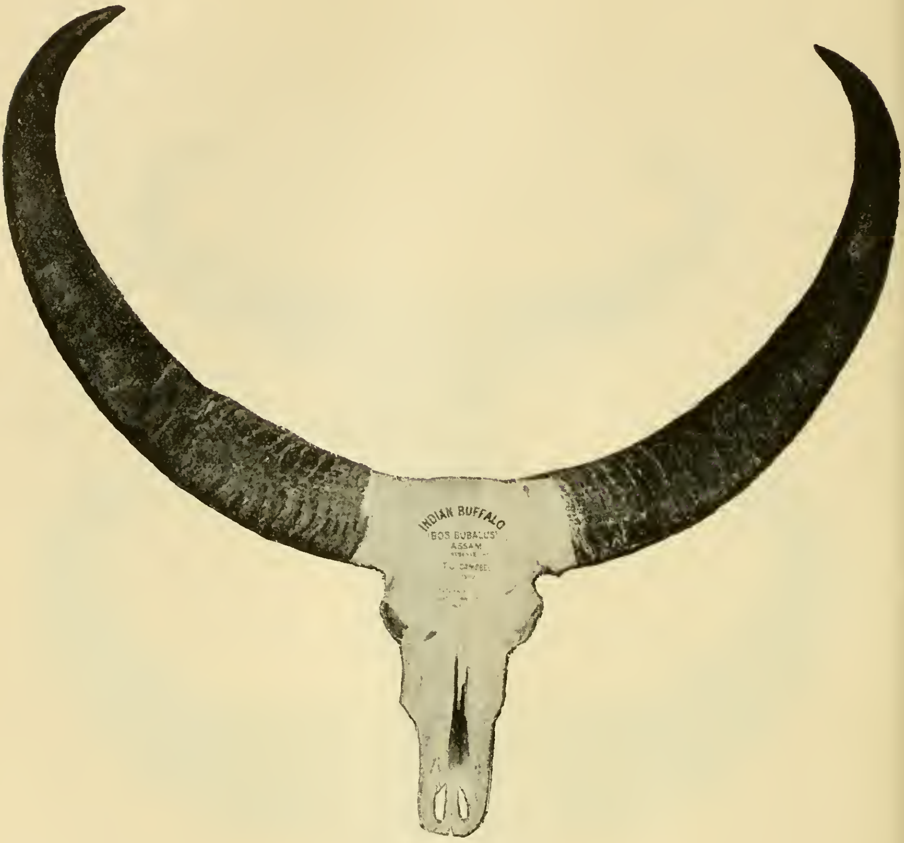
GAUR (*BOS GAURUS*).

Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.
		Right.	Left.	Right.	Left.		
Burma	A. J. A. Jardine	39½	38½	18½	18½	43	18½
Travancore	Purchased	31	30½	17	17½	41	28½
Kanara . ..	T. R. Bell	29½	30	18	18	39	23½
,, ...	T. R. Bell	27½	26½	17	16	34½	21
,, ...	Purchased 1882	23½	27½	15	15½	33	20



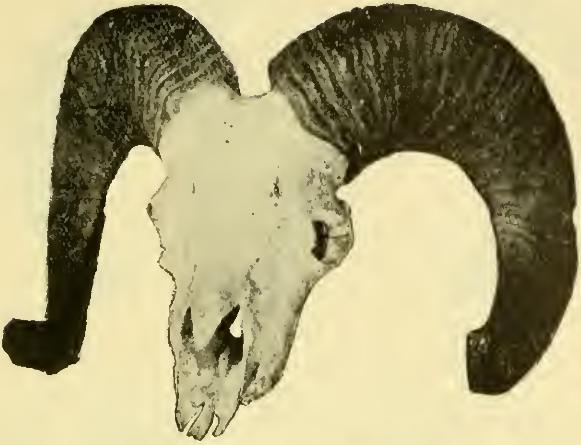
BANTING (*BOS SONDAICUS.*)

Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.
		Right	Left.	Right.	Left.		
Burma	A. A. Jardine	30	29	15½	15	38½	20
.. ..	Vet. Major G. Evans	23	23	11½	11½	31	18½
,, ...	Vet. Major G. Evans	22¾	23	13	13	31½	23


INDIAN BUFFALO
'BOS BUBALUS'
ASSAM

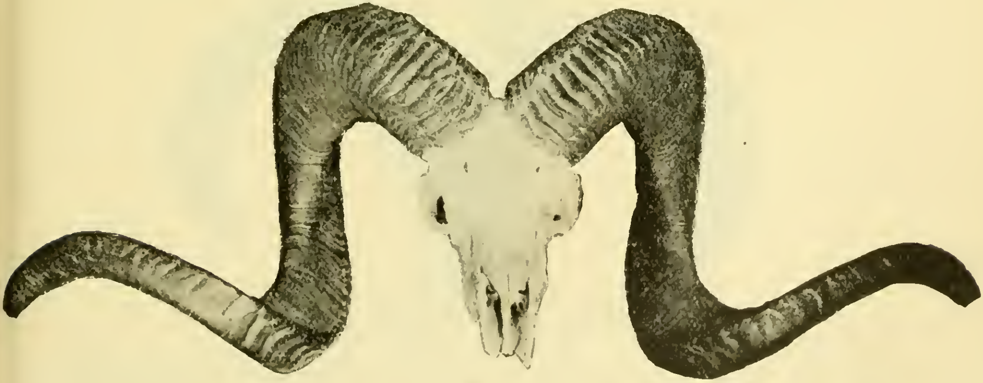
BUFFALO (*BOS BUBALUS.*)

Locality.	How obtained.	Length.		Circumference.		Widest Inside.	Tip to Tip.
		Right	Left.	Right.	Left.		
Assam..	T. J. Campbell..	54½	54	18½	18½	62¼	46
"	T. J. Campbell	46	45½	17¾	18	54¾	41½



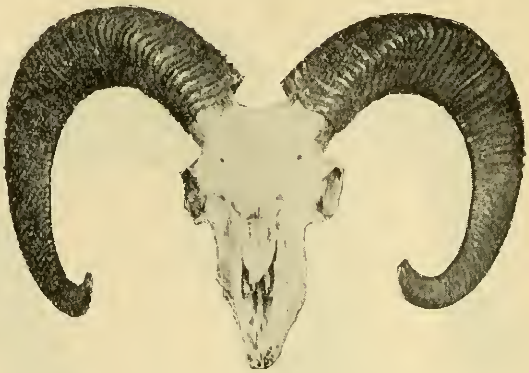
HODGSON'S SHEEP (*OVIS AMMON HODGSONI*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Dauvergne Collection, purchased 1885 ..	39½	39	18	18¼	20¾
......	Dr. Banks	36	34	17	16¾	17
......	Dauvergne Collection, purchased 1885 ..	33¼	34½	16	16	18
......	Capt. H. V. Bennett	26½	25¼	15	15	23¾



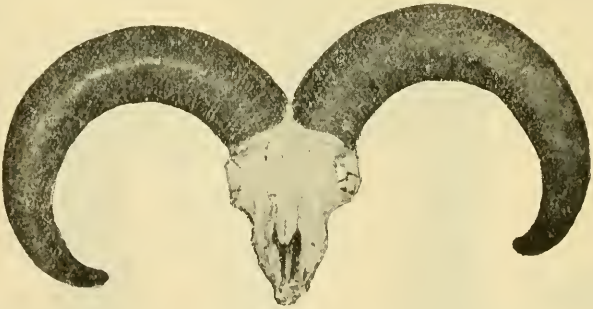
MARCO POLO'S SHEEP (*OVIS POLI*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right	Left.	Right.	Left.	
......	Exchanged with Amuradin Tyabji ..	62	60	16	16	50
......	Dauvergne Collection, purchased 1885 ..	60	57	16	6	46
......	Amuradin Tyabji	55	58	17	17	44



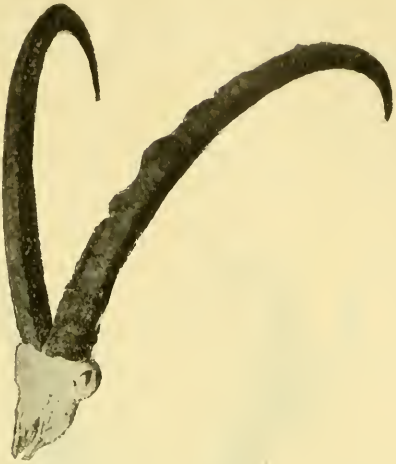
URIAL (*OVIS VIGNEI*).

Locality.	How obtained.	Length,		Circumference.		Tip to Tip.
		Right	Left.	Right.	Left.	
......	Dauvergne Collection, purchased 1885 ..	31	30	9	9	59
......	Col. H. E. Ryves, 1889	30	29	10¼	10¼	11
......	Dauvergne Collection, purchased 1885 ..	25	25½	11¾	12	12½
......	Capt. F. B. Pelle, 1886..	24¾	21	12	12	20½



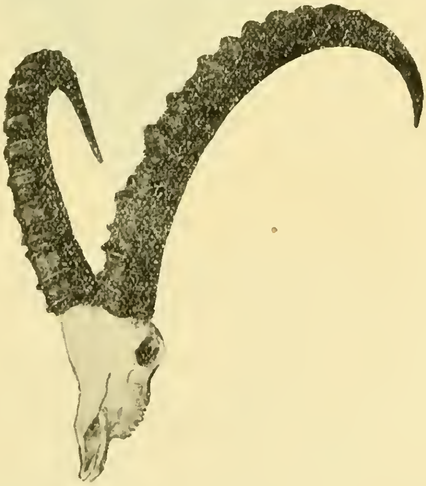
BURHAL (*OVIS NAHURA*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Dauvergne Collection, purchased 1885 ..	25¾	25½	10¼	10¼	18
......	” ” ” ..	23½	23½	10¾	10¾	19½
......	” ” ” ..	18½	19¼	10¼	10¼	23½
......	” ” ” ..	18¼	19¼	10½	10¼	21¼



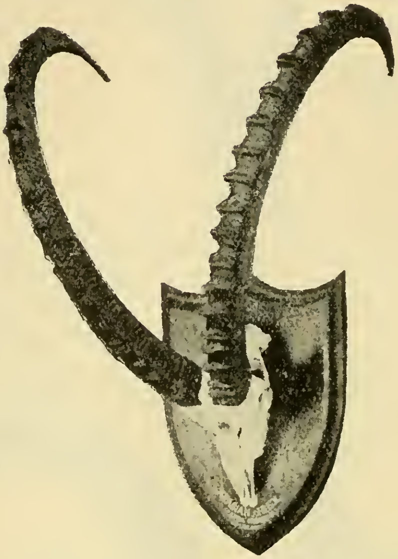
SIND WILD GOAT (*CAPRA HIRCUS BLYTHI*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	B. F. Finch, 3rd March 1886..	38½	37	8	8	8



HIMALAYAN IBEX (*CAPRA SIBIRICA—?*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	......	44	45	11½	11½	25
......	......	44	44	10¾	11	12¼
......	......	42	41	10¼	10	29½
......	......	41½	44	9½	10½	34½
......	......	39½	40½	10½	10½	31
......	......	39	39	9	9½	15
......	......	38½	39¼	11	11	25
......	......	38½	37	8	8	8

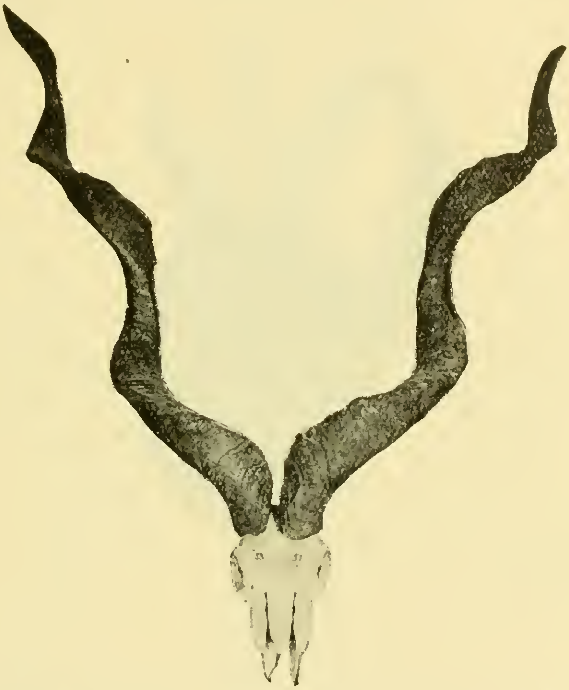


ARABIAN IBEX (*CAPRA NUBIANA—?*).

Locality.	How obtained.	Length		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Capt. P. Z. Cox	36¼	36¼	8½	8½	17¼

MARKHOR (*CAPRA FALCONERI*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	......	33¾	33¾	9¾	10	34

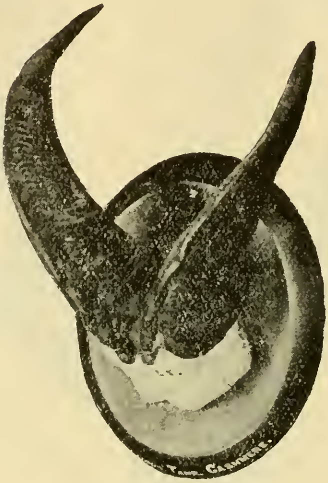


PIR PANJAL MARKHOR (*CAPRA FALCONERI CASHMIRIENSIS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	......	53	50½	9¾	10¼	34½
......	......	53	47¾	11¼	12	38
......	......	45¼	45	10½	10	33½
......	......	41½	41½	10½	10½	27½

CABUL MARKHOR (*CAPRA FALCONERI MEGACEROS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	......	33	33½	10	10¼	23
......	......	32	30½	10	9¾	20½

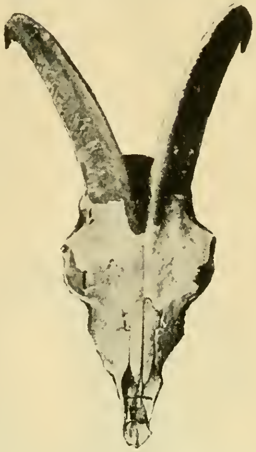


THAR (*HEMITRAGUS JEMLAICUS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right	Left.	Right.	Left.	
......	H. Bicknell, 1887	13½	12½	9¼	9	8¼
Cashmere	Col. H. E. Ryves, 1889	12¾	12¾	8½	8¾	6¼

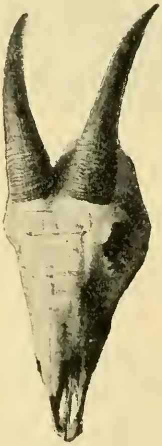
NILGIRI THAR (*HEMITRAGUS HYLOCRIUS*).

Loclaity.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Dr. E. C. Gaye, 1887	13½	13¼	9	9	4½
......	Major Rodon, 1895	13	13	7½	7¾	5
......	E. M. Slater, 1886	8¼	8	6¼	6¼	4¼



ARABIAN THAR (*HEMITRAGUS JAYAKARI*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Capt. P. Z. Cox	11½	11½	5⅓	5⅓	6¾

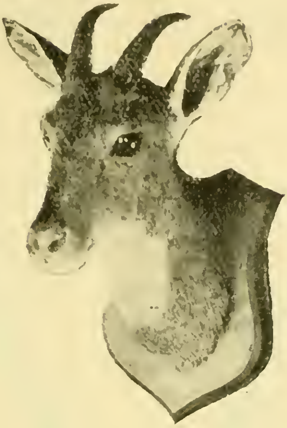


HIMALAYAN SEROW (*NEMORHŒDUS BUBALINUS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
Kashmir	Dauvergne Collection, purchased 1885 ..	8¼	9½	5¼	5½	¼

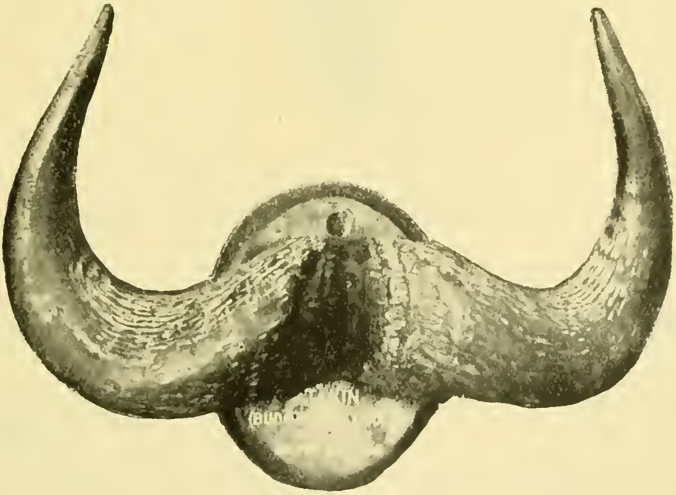
SUMATRAN SEROW (*NEMORHŒDUS SUMATRENSIS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip
		Right	Left.	Right.	Left.	
Burma	Vet. Major G. Evans, 1897	9	9	5½	5½	5½



GORAL (*CEMAS GORAL*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
Kulu	Lt.-General Osborn, 1907	6¼	6¼	3½	3½	3¼
Burma	Vet. Major G. Evans	damaged 1	5½	..	3½	..

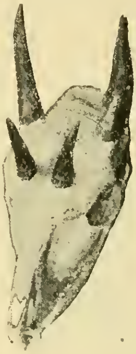


TAKIN (*BUDORCAS TAXICOLOR.*)

Locality.	How obtained	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
......	Major J. H. Yule	28¼	20½	12½	12½	12½

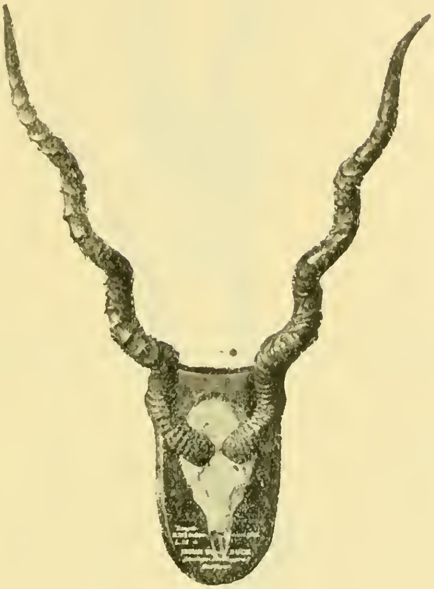
NILGAI (*BOSELAPHUS TRAGOCAMELUS*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right.	Left.	Right.	Left.	
……	Purchased	7¾	7¼	7	6¾	5¾
Rajputana	Major P. Kilkelly, I.M.S.	7¼	7	6½	6½	4¾



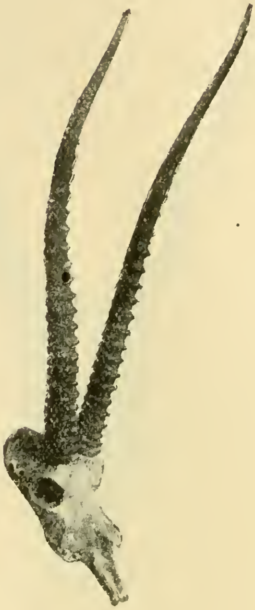
FOUR-HORNED ANTELOPE (*TETRACEROS QUADRICORNIS*).

Locality.	How obtained.	Length.				Tip to Tip.	
		Anterior.		Posterior.		Anterior.	Posterior.
		Right.	Left.	Right.	Left.		
……	J. D. Inverarity, 1886	..	..	3·8	3·4	..	1·35
……	Victoria Gardens, Bombay	1·4	1·3	3·75	3·7	1·	2·5
Central Provinces ..	J. C. Anderson, 1889	1·75	2·05	3·4	3·3	1·85	2·7



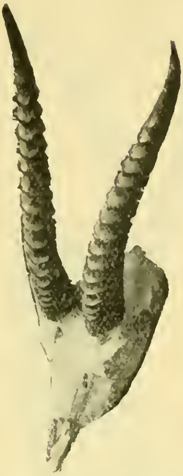
BLACK BUCK (*ANTILOPE CERVICAPRA*).

Locality.	How obtained.	Length.		Tip to Tip.
		Right.	Left.	
Amritsar (?)	H. M. Phipson, 1906	26⅝	26	18¼
Rewah, C.I.	Lt.-Col. Donald Robertson	25	24¾	13
......	......	24	23⅞	14
......	......	23	22⅝	15¼
......	......	22¾	22⅜	16½
......	......	21⅞	22	18
......	......	21⅜	21¼	17½
......	.....	21¼	21¼	15



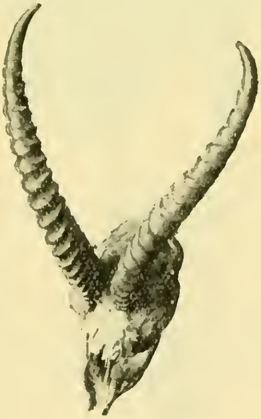
TIBETAN ANTELOPE (*PANTHOLOPS HODGSONI*).

Locality.	How obtained.	Length.		Tip to Tip.
		Right.	Left.	
......	Dauvergne Collection, purchased 1885.	24	24	10
......	......	22	22	9½
......	......	21½	21½	9¼



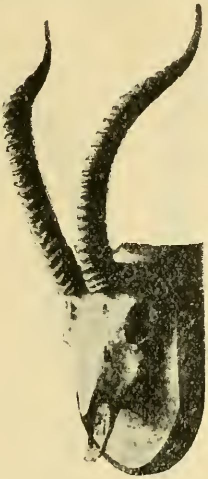
INDIAN GAZELLE (*GAZELLA BENNETTI*).

Locality.	How obtained.	Length.		Tip to Tip.
		Right.	Left.	
......	R. A. Sterndale	11¾	11¾	4½
......	......	11¾	11¾	..
......	......	11½	11¾	4
Udaipur	Colonel C. W. Ravenshaw, 1898 ..	11	11	4¾



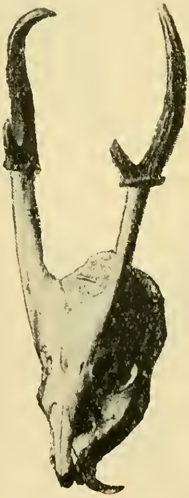
PERSIAN GOITRE GAZELLE (*GAZELLA SUBGUTTUROSA*).

Locality.	How obtained.	Length.		Tip to Tip.
		Right.	Left.	
......	Capt. A. Houston	10¼	10¼	6½
......	Capt. A. Houston	8¼	8½	6¼



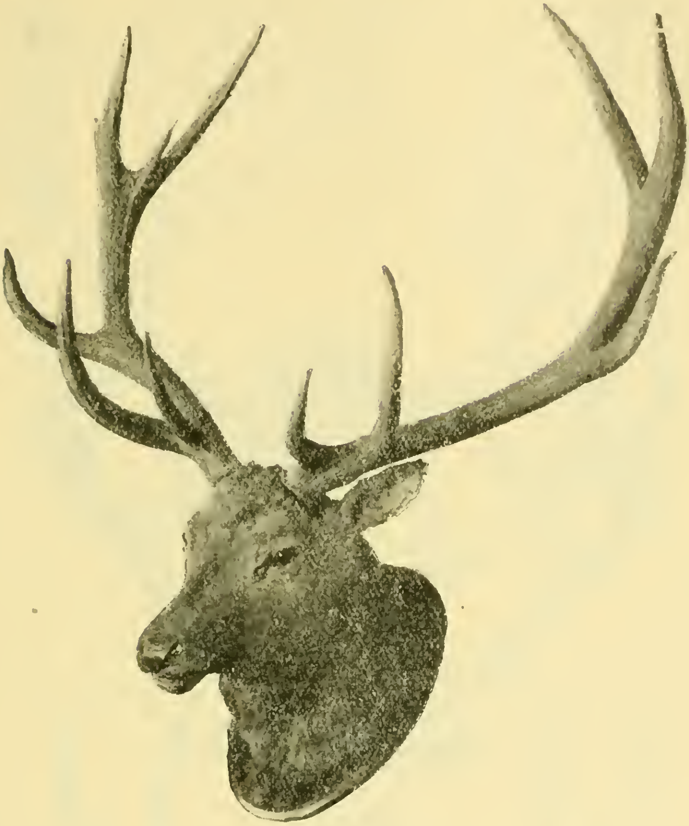
TIBETAN GAZELLE (*GAZELLA PICTICAUDATA*).

Locality.	How obtained.	Length.		Tip to Tip.
		Right.	Left.	
......	......	13	13	5¾
......	T. R. G. Beatty, 1908	12	12	5¾



RIB-FACED DEER (*CERVULUS MUNTJAC*).

Locality.	How obtained.	Length.		Circumference.		Tip to Tip.
		Right	Left.	Right.	Left.	
......	......	5¾	5¾	2¼	2¼	3¼
......	H. E. Bartlett	6¼	5¼	2¼	2¼	3¼



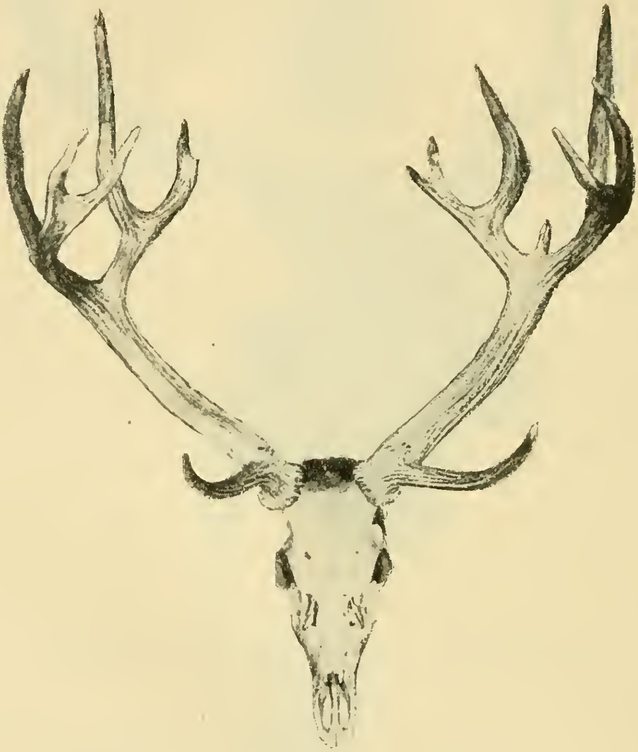
KASHMIR STAG (*CERVUS CASHMIRIANUS*).

Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right	Left.			Right.	Left.
......	Dauvergne Collection, purchased 1885.	44½	46	10½	10	35½	20¾	6	5
......	Exchanged with M. Dauvergne, 1886.	44	..	7½	deformed.			5	..
......	Dr. Banks	43	43½	7¾	8½	32½	13	5	5
......	Dauvergne Collection, purchased 1885.	41	40	6¾	6	31¼	21	6	6
	" .. " ..	39	38	7¼	7⅓	29	25	7	7

SIKHIM STAG (*CERVUS AFFINIS*).

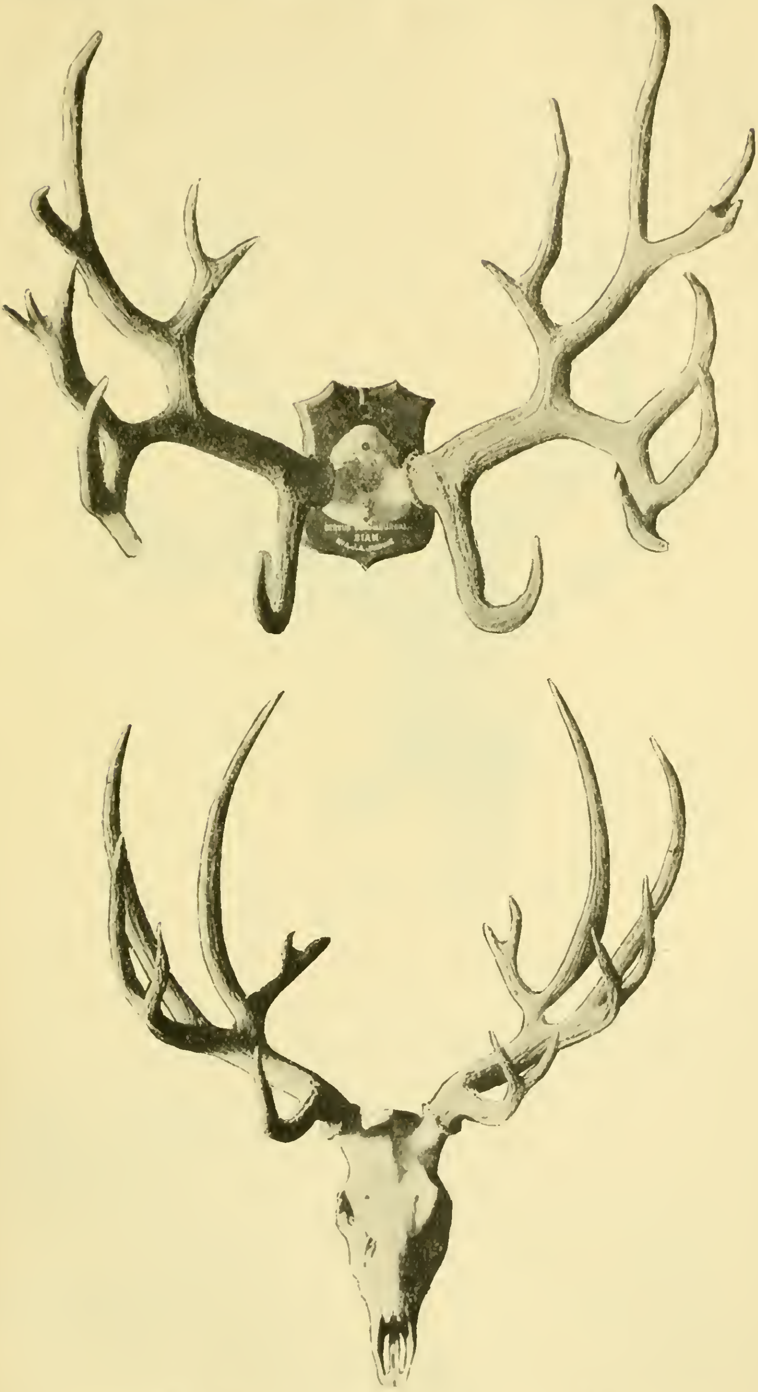
Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
......	Lt. R. S. S. Shuttleworth, 1905.*	..	46½	..	9½	..	..	..	4

* Single horn only.



SWAMP DEER (*CERVUS DUVAUCELI*).

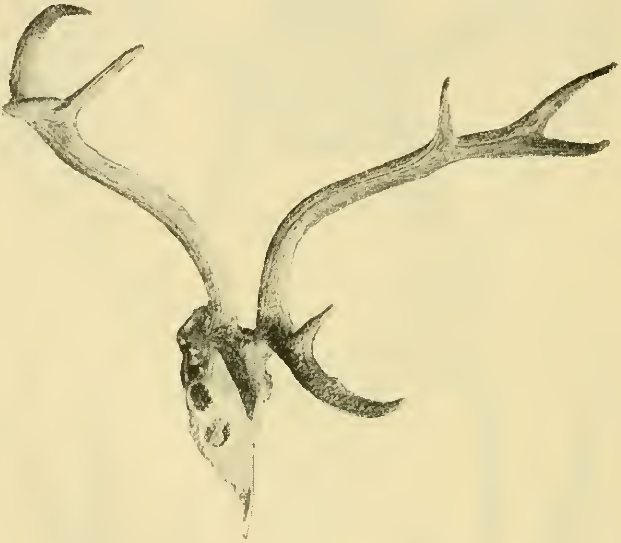
Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
......	....	37½	36	4¾	4¾	31	28	5	5
......	J. F. Snuggs	33	33½	5¼	5¼	28½	31	5	6
Shillong, Assam..	Mrs. Jackson, 1908	33½	32	4¼	4¼	30⅛	19	7	10



SCHOMBURGK'S DEER (*CERVUS SCHOMBURGKI*).

SCHOMBURGK'S DEER (*CERVUS SCHOMBURGKI*).

Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
Siam	A. J. A. Jardine, 1897 ..	30½	31½	6½	6½	27½	24	10	13
,, ...	J. Slade, 1897	29½	30	5½	5½	28¼	15	7	8
,, ...	C. J. Davidson, 1903 ..	broken.	26¼	4½	4½	23	..	7	8



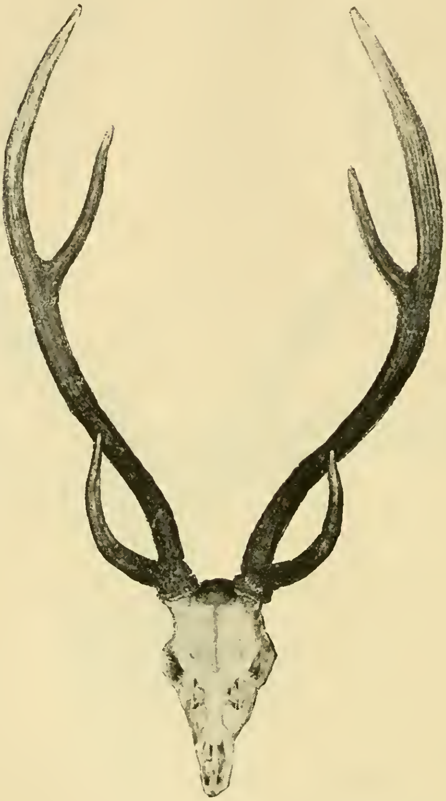
BROW-ANTLERED DEER (*CERVUS ELDI*).

Locality.	How obtained.	Length.		Circumference.		Brow tine.		Widest Inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.	Right.	Left.			Right.	Left.
Burma ..	Vet. Major G. Evans, 1897.	35	35	5¼	6	15	deformed.	27	22	5	..
....	Capt. Gwyn, 1891.. ..	33½	34	5	5	14	13	20¼	10½	2	3
....	Dr. T. S. Weir	33½	34	5	5¼	defor	med.	27	18¼	7	6

SAMBAR (*CERVUS UNICOLOR*).

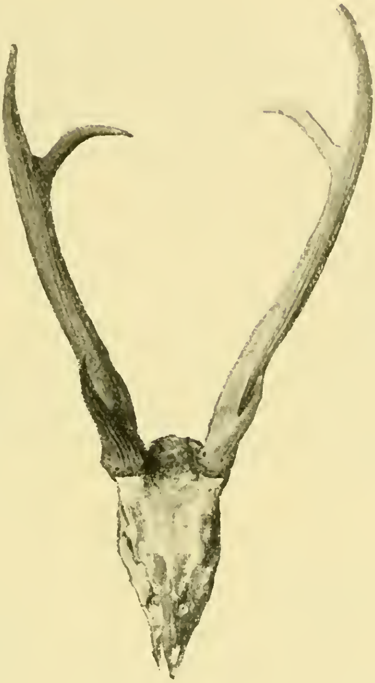
Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
Tapti River ..	R. Gilbert	..	44½*	..	..	..	..	..	..
Gathar Jungles, Nimar, C. P. (picked up).	S. D. Smith	43¾	..	10½	..	..	..	..	..
......	......	39¾	40½	9	7¾	27½	21	2	3
Kumaon, N.-W.P.	Capt. M. D. Roberts, 1902 ..	39	39¾	8	8	29¼	27	3	3
.. ...	. ...	37	38½	6	6¼	..	..	3	3
Rewa Kantha Jungles (picked up).	J. Strip	..	37	..	11	..	..	..	..
.....	......	35¼	36	8	7¼	27⅓	18	3	3

* Shot off above brow tine.



SPOTTED DEER (*CERVUS AXIS*).

Locality.	How obtained.	Length.		Circumference.		Widest inside.	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
......	......	34¼	34	3¾	4½	22¾	17	3	3
Belgaum (picked up).	W. A. Wallinger, 1908 ..	33½	32½	3¾	4	22	12¼	3	3
......	......	32	32½	3½	4	18	14	4	3
Karwar	T. R. Bell, 1892	32	31	3¼	3¾	18½	13¼	3	3
......	......	31¼	32	3¾	3¾	12½	14¼	4	4
......	......	31	30	3½	4	8½	10	4	4



HOG-DEER (*CERVUS PORCINUS*).

Locality.	How obtained.	Length		Circumference.		Widest inside	Tip to Tip.	Points.	
		Right.	Left.	Right.	Left.			Right.	Left.
Purneah	J. Shillingford. 1885 ..	20¼	19¼	3	3	12½	10½	3	3
......	Dauvergne Collection, purchased 1885.	18	20	3¼	3¼	10½	11¼	3	3
Purneah	J. Shillingford, 1885	19½	19	3¼	3¼	10½	8½	3	3
......	Dauvergne Collection, purchased 1885.	19½	19½	3	3	15¾	17	3	3

From the above list it will be seen that the Society has a fairly good foundation on which to build up a really good collection of horns if Members will only help.

In many species, Sambar, Urial, Ibex and Markhor especially, the heads are not by any means up to the standard they ought to be, and in these species also, several of the local races are entirely wanting in the collection. This should not be the case considering the number of the Society's Members who have shot or do shoot in the districts inhabited by these animals.

It is hoped that in giving the following list of wants of the Society, Members may see their way to help us to get together a really fine collection of heads from India and the neighbouring countries. At the same time, we should like to point out that not only heads are wanted, but also skins which in many cases are needed to distinguish the local races. Whether, in all cases, these local races really hold good has not been proved, and Members by sending in carefully located specimens would always be helping to test them.

Frequently on their shooting expeditions sportsmen must come across horns of animals, which have either been wounded or killed by carnivorous animals ; these, if good specimens, we are always glad to have, especially females of the different kinds of sheep and goats, this being the only way one can hope to obtain them.

LIST OF WANTS.

Gayal or Mithan (*Bos frontalis*)	Assam.
Yak (*Bos grunniens*).............	Tibet.
Hodgson's Sheep (*Ovis ammon hodgsoni*)...............	Tibet and Ladak.
Urial (*Ovis vignei*)	Astor and Ladak.
Baluchi Urial (*Ovis vignei blanfordi*)..................	Baluchistan.
Salt-Range Urial (*Ovis vignei cycloceros*)......... ..	Salt-Range and other Cis Indus districts of the Punjab.
Kopet-Dagh Urial (*Ovis vignei arkal*)	Persia and Turkestan.
Bharal or Blue sheep (*Ovis nahura*)...	Tibet and Himalayas.
Sind Wild Goat (*Capra hircus blythi*)	Sind and Baluchistan.
Persian Wild Goat (*Capra hircus aegagrus*)............	Persia.
Baltistan Ibex (*Capra sibirica wardi*)	Baltistan.
Himalayan Ibex (*Capra sibirica sacin*)	Zoji-la (between Kashmir and Dras).
Markhor (*Capra falconeri*).................................	Astor and Baltistan Range.
Pir Panjal Markhor (*Capra falconeri cashmirensis*)	Pir Panjal northwards into Hazara and Chilas.
Sulemán Markhor (*Capra falconeri megaceros*)...	Sulemán Range.
Cabul Markhor (*Capra falconeri jerdoni*)	Northern Afghanistan.

Serow	Himalayas, Assam and Burma.
Goral	Himalayas, Tibet and Burma.

[In a future number of the Journal, Mr. R. I. Pocock, of the Zoological Gardens, London, is writing an article on the Serows and Gorals, and till that article appears, it is perhaps better not to enumerate the various local races of these two animals. At the same time we should like to make it clear to members that we want skins and heads of these animals from all the different localities where they are found.]

Four-horned Antelope (*Tetraceros quadricornis*)	Specimens from Madras and Kathiawar are especially wanted as they are said to have frequently undeveloped anterior horns in these localities.
Tibetan Gazelle (*Gazella picticaudata*)	Tibet.
Persian Goitre Gazelle (*Gazella subgutturosa*)	Persia.
Yarkand Goitre Gazelle (*Gazella subgutturosa yarkandensis*)	Yarkand and Kashgar.
Indian Gazelle (*Gazella bennetti*)	India.
Yarkand Stag (*Cervus yarcandensis*)	Yarkand.
Shou or Sikkim Stag (*Cervus affinis*)	Tibet, Chumbi Valley and Bhutan.
Thorold's Deer or Lhasa Stag (*Cervus albirostris*)	Tibet.
Sambur (*Cervus unicolor*)	India.

[We have no specimens of Sambur from Ceylon.]

Malay Sambur (*Cervus unicolor equinus*)	Burma and Malay Peninsula.
Siamese Brow-Antlered Deer (*Cervus eldi platyceros*)	Siam.
Muntjac (*Cervulus muntjac*)	India.
Tibetan Muntjac (*Cervulus lachrymans*)	Eastern Tibet.
Tenasserim Muntjac (*Cervulus fea*)	Tenasserim.
Tibetan Tufted Deer (*Elaphodus cephalophus*)	Eastern Tibet.
Musk Deer (*Moschus moschiferus*)	Himalayas.
Chevrotain or Mouse Deer (*Tragulus meminna*)	India.
Large Malay Chevrotain (*Tragulus napu*)	Tenasserim & Malay Peninsula.
Small Malay Chevrotain (*Tragulus javanicus*)	do. do. do.

REVIEW.

" VENOMS, VENOMOUS ANIMALS AND ANTIVENOMOUS SERUM THERAPEUTICS,"—BY A. CALMETTE, M. D.

TRANSLATED FROM THE FRENCH BY MR. G. E. AUSTEN.

The English translation of Mr. Calmette's book on poisonous animals and their venoms should be very acceptable to workers in India and the British Colonies who are not familiar with the author's own language in which the original work appeared about two years ago. For the work contains the results of the labours of one who has devoted a great deal of time and trouble to investigations on the problems included under the title. It is, therefore. worthy of careful study and although we may disagree with some of the opinions held and now put forward by Dr. Calmette, it is nevertheless a pleasure to have to deal with the writings of one who has really worked at his subject and who has not merely taken his information from the work of others. The volume will also be of interest to those who, although not workers on the subject are desirous of acquainting themselves with it, as Dr. Calmette has a very pleasant style of writing and the translator has not detracted from it.

Part I of the present volume is devoted to a general description of poisonous serpents, to their classification and to their physiological anatomy. The numerous illustrations will aid the reader in a proper understanding of the descriptions. The habits of snakes are then dealt with and the methods by means of which they are captured and treated when in captivity are described in detail. It ends with a complete catalogue of the different species of these reptiles, accompanying which is a more or less detailed description of each species arranged geographically. The classification is founded on the description and nomenclature of Boulenger and abundant use is made of the catalogue of snakes issued by the British Natural History Museum.

The illustrations in this part of the work are very interesting and add much to the value of the text.

Part II is taken up with a description of the chemical, physical and physiological properties of the venoms of the different species of snakes and is very unequal ; in some respects it is markedly deficient and inaccurate. Thus in the chapter on the method of collecting the poison we notice that Dr. Calmette reproduces a table from one of his earlier writings in which he sets down the amounts of dried venom which can be got from the adult cobra. The largest quantity which he was able to obtain was 48 milligrammes, a quantity about ten times less than has been got by workers in India. The importance of this point will be apparent when we come to the part which deals with the serum therapeutics of snake bite. The physiological actions of venoms are not dealt with in a manner worthy of a book of the size and importance of the present volume. There is a tendency throughout to convey the idea that these actions are very much simpler than they have been shown to be, and the work of such men as Brunton and Fayrer, Messrs. Mitchell and Reichert, Martin, Lamb, Elliot, Rogers, Ellut, and Fraser, which work forms the essential part of our knowledge as to how the various venoms exercise their action on the animal organism is not even mentioned. Finally, the author falls into a very serious error when he states that the venom of no colubrine snake exerts a coagulating effect on the blood, as the poisons of many of the Australian snakes, of the Indian *Bungarus faciatus,* all of which belong to the colubridæ, contain extraordinary active fibrin ferments. Again the Australian snake, *Caotechis pseudechis,* is wrongly described as producing an anti-coagulatory action.

Chapter X deals with the toxicity of the blood of venomous snakes and shows that the blood is toxic for certain animals, but owes this property to substances other than those contained in the venom.

Chapters XI and XII give an account of the natural immunity of certain animals with respect to snake venom and of snake charmers and their ways of working. The illustrations of the Indian snake charmer with his fangless or glandless cobra will be familiar to most of us.

The third part of the volume, perhaps the most important from the popular standpoint, deals with the serum therapeutics of snake bite and against many statements and practical instructions contained therein we would enter a most strong protest.

The history of the discovery of anti-venomous serum is briefly narrated so that the reader has no difficulty in seeing the part which Dr. Calmette took in this most important work. It will be remembered that at the time a certain amount of controversy took place with regard to priority as claimed by Dr. Calmette and by Sir Thomas Fraser of Edinburgh. There is no doubt that the credit of first establishing the fact that antitoxins to venom were formed in the serum of an animal, which could be used for therapeutic purposes, is due to Calmette, although similar investigations with other venoms were being carried on more or less simultaneously by Phisalix and Fraser.

The details of the process of immunising horses for the purpose of procuring antivenine are fully described and the difficulties encountered in the course of immunisation are explained. Although the method is now somewhat departed from in India, this description should form an excellent guide to any workers in the same field. Next comes the most important and much disputed question of specificity. Already before this Society in past years papers have been read and published in the Journal on this very subject. These communications have shown that Calmette's claims for the serum being able to neutralise all venoms are not founded on true experimental data and must be given up.

In the present volume our author has somewhat modified his position. He now holds that the venoms of snakes, no matter what their origin, contain only two principal substances, a neurotoxine, acting on the nervous system, and a hæmorrhagin, acting on the blood, and that poisons only differ from one another in the relative amounts of these substances which they contain. He further holds that colubrine venoms in general contain neurotoxine and viperine venoms hæmorrhagin : also that a serum prepared with the venom of one colubrine serpent is antitoxic for the poisons of all other colubrine snakes and that a serum prepared with the poison of any viperine snake neutralises the venoms of all other snakes of this group. We cannot too strongly repudiate this view. The recent work which has been done in Australia, in America and in India is quite against it and the general consensus of opinion of all other workers but Calmette is that both 'en viro' and 'in vitro' anti-venomous serums are highly but not strictly specific. For this reason we hold that Dr. Calmette is wrong in recommending a serum prepared with cobra venom alone as useful in the case of bites from other colubrine snakes. It would appear on the other hand that the specific anti-serum alone would be of use in a case of snake venom intoxication. The same principles hold good in the case of the venoms of viperine snakes and their anti-serums.

Chapter XV is devoted to the practical treatment of snake bite. For local treatment the author recommends the injection into the situation of the punctures of a solution of hypochlorites. No mention is made of the Lauder Brunton lancet or of dissection as recommended by the elder Wall. Local treatment, no matter of what kind, is limited to destroying whatever portion of unabsorbed poison may be brought in contact with it. Once absorbed the only remedy is antitoxin. The technique of serum injection is fully described with illustrations and 10 to 30 cubic centimetres of serum according to the severity of the symptoms is the dose recommended. This recommendation is made on the basis that 1 c.c. of serum is able to neutralise 1 milligramme of cobra poison, that the minimum lethal dose for an ordinary man is about 14 milligrammes and that a cobra will inject an average amount of about 20 milligrammes. With the first two of these suppositions we can agree as the experimental evidence is in harmony with them. But as we have already pointed out an Indian Cobra may inject a much larger amount than the equivalent of 20 milligrammes of dried venom. We have ourselves recovered as much as 300-400 milligrammes of dried poison from the fluid ejected into a watch glass at one bite of a fresh adult cobra. Moreover, in practice the antitoxin is not mixed with the venom before injection but at variable times subsequently and both Fraser and Martin have shown that this makes a very great difference, for these reasons we hold that the doses recommended by Dr. Calmette require multiplying by ten to reach reasonable security and even this quantity would be inadequate in some cases. Further we would recommend that the serum should in all cases be injected intravenously and not under the skin. We could thus bring the antitoxin in contact with the venom as soon as possible. There are no doubt many cases of snake bite in which for many reasons the snake does not inject its full complement of poison and for such treatment with the smaller quantities injected subcutaneously would suffice. As about

30 per cent. of those bitten by cobras recover without treatment, it is probable that the dose and method of injection recommended by Dr. Calmette would be adequate for a number of cases but it must always be remembered that if the larger amounts of serum are not injected and the intravenous method not adopted the treatment may fail because more than a lethal dose of poison remains unneutralised. The fourth part of the work is occupied with a description of what is known of the poisons of animals other than serpents, both invertebrate and vertebrate. There are copious illustrations of these venomous creatures and many interesting facts are recorded. The volume is brought to a close with a number of reports of cases of various forms of snake bite treated with anti-venomous serum most of which recovered.

OBITUARY.

Lieut.-Colonel C. T. Bingham.

To his many friends in India and Burmah, as to all interested in Indian Zoology, the news of the death of Lieut.-Colonel Charles Thomas Bingham, late Bengal Staff Corps and Conservator of Forests, Burmah, will have come as a shock. Colonel Bingham was widely known as a keen naturalist, who, during his long service in Burmah, devoted himself to the study of Natural History, and who was surpassed by none in his devotion to science and in his constant endeavour to add to the sum of knowledge in his branch. Though his work was not crowned with academic honours or the fellowship of learned societies, it will rank with that of Wood-Mason and de Nicéville, and to no one has it been possible to so signally advance the study of the subject to which he devoted himself. Large collections of his making were sent home and formed the basis of much of the *Fauna of India* volumes; he was a keen observer and added much to our knowledge of the ways and habits of the bees and wasps, a group to which he especially devoted himself. His earliest papers related to birds and were published in *Stray Feathers* from 1876 to 1881. His attention was then directed mainly to insects and he achieved the rare distinction of combining the rigid accuracy of the systematist with the breadth of view and power of observation necessary to study the living insect in its many activities and varied habits. The Aculeate Hymenoptera of India and Burmah were his special study, and the two volumes of the *Fauna of India*, dealing with them, were his work. On his retirement he settled in London, and devoted all his time to this work; he succeeded Dr. Blanford as Editor of the *Fauna of India* in 1905, and workers in Indian Entomology will owe a great debt to his untiring efforts to secure the co-operation of authorities in Zoology and to give help of every possible kind to workers in India. Colonel Bingham took up the work of producing the volumes on the Butterflies for the *Fauna of India*, rendered necessary by the death of Mr. Lionel de Nicéville; so great an undertaking achieved bears witness to his devotion to Science, two volumes, dealing with the Nymphalids, Papilionids, Pierids and part of the

Lycænids, were published and the completing volume was in preparation at the time of his death. The members of this Society, as all who knew him personally, will endorse the words of 'Nature': "He will be widely regretted by all who knew him, not only as a great naturalist, but also as a dear and valued friend."

H. M. L.

ON THE EXISTING "CLOSE TIME" FOR BIRDS AND ANIMALS IN THE BOMBAY PRESIDENCY.

BY

J. E. C. Jukes, I.C.S.

I have been asked to put on paper, for the benefit of readers of the Journal, a brief note on the subject of the existing regulations prescribing a "close time" for game animals and wild birds in the Bombay Presidency. We have, at present, two sets of rules. One set has been issued under the Indian Forest Act, and applies only to areas included in Reserved and Protected Forest. The other set is an offspring of the Wild Birds Protection Act, and concerns only the boundaries of municipalities and cantonments. The Forest regulations are universal, and apply to all Protected and Reserved Forests in the Presidency; but rules under the Wild Birds Protection Act are framed by the local bodies concerned, and vary with the conditions of localities and the fancies of issuing authorities. There are still municipalities which have adopted no rules under the Act.

To deal first with the rules under the Forest Act. These prescribe no close time for any quadruped except the hare, though they prohibit the wounding or killing of females of deer, antelope and bison at all time, and the taking, wounding or killing of any big game, except certain specified beasts of prey, over water or salt-licks. In the case of the hare and of certain species of game birds, a definite close time is laid down, within which wounding or killing is forbidden. The appended list shows the protected species and the breeding season ascribed to each of them.

		Close Season.	
Sand-grouse	*Pterocles fasciatus*	1st April to 30th September.	
	Pteroclurus exustus		
Pea-fowl	*Pavo cristatus*	Do.	do.
Jungle-fowl	*Gallus sonneratti*	Do.	do.
Spur-fowl	*Galloperdix spadicea*	Do.	do.
	Galloperdix lunulata		
Partridge	*Francolinus vulgaris*	Do.	do.
	Francolinus pictus		
	Ortygornis or *Francolinus pondicerianus*.		
Rain-quail	*Coturnix coromandelica*	Do.	do.
Bush-quail	*Perdicula argoondah* or *argoonda*.	Do.	do.
	Perdicula asiatica		
	Microperdix erythrorhynchus		
Bustard-quail	*Turnix pugnax*	Do.	do.
	Turnix gondera or *tanki*		
	Turnix dussumieri		

		Close Season.
Bustard	*Eupodotis edwardsi*	1st April to 30th September.
Likh-florican	*Sypheotides* or *Sypheotis aurita*	
Whistling-teal	*Dendrocygna arcuata* or *javanica.*	1st June to 30th September.
Cotton-teal	*Nettopus coromandelianus*	Do. do.
Comb-duck	*Sarcidiornis melanonotus*	Do. do.
Spot-bill-duck	*Anas pœcilorhyncha*	Do. do.

The close season for Hare is 1st April to 30th September.

The Forest rules are simple and uniform and are probably within the knowledge of most readers of this paper. When we come to municipal regulations, the case is different. The prohibited actions are the same everywhere. It is forbidden, within the limits of the municipality or cantonment, "to possess or sell during the breeding season any wild bird or other animal of game which has recently been killed or taken;" and "to import its plumage or fur into the said limits during the said season." The definitions of wild birds and of other animals of game, however, as well as the periods of the close season, vary considerably in different localities.

The most representative list is that drawn up by the Ahmedabad Municipality in 1901, which was subsequently adopted by practically all the Municipalities of Gujarat, as well as by many in the Southern Maratha country. In Ahmedabad, "other animal of game" means a hare, and its breeding season extends from May 1st to October 1st in each year. "Wild birds," with their close times, are as shown below. "Wild Goose" presumably refers to the Cotton Teal.

		Close time.
Grey, black or painted Partridge.		From 15th March to 15th September.
Quail		From 1st May to 1st September.
Painted Snipe.		From 1st April to 1st October.
Wild Duck.		
Wild Goose.		
Peacock.		
Large white Heron.	*Herodias alba*	From 1st April to 1st November.
Lesser white Heron or smaller Egret.	*Herodias intermedia*	
Little black-billed white Heron or little Egret.	*Herodias garzetta*	
Cattle Egret.	*Bubulcus coromandus*	
Common or blue Heron.	*Ardea cinerea*	
Pond Heron.	*Ardeola grayi*	

		Close time.
Large Egret	*Herodias torra*	From 1st April to 1st November.
Night Heron	*Nycticorax griseus*	
Crested Grebe	*Podiceps cristatus*	
Bustard ...	*Eupodotis edwardsi*	From 1st May to 1st September.

This list has been followed by every Municipality in Gujarat which has issued rules. It has also been appropriated, with slight variations, by the Municipal Corporation of Bombay. The latter body substitutes for the Bustard and Crested Grebe, the Coot and Water-hen, with a close time extending from April 1st to October 1st; while it ascribes a similar breeding season to the Herons and Egrets, and protects the Partridges and Quails from April 1st to September 1st. Of the other localities which will interest the Bombay sportsman, practically all the municipalities of the Thana District follow the Ahmedabad list. Bandra alone, in the pride of ornithological knowledge, strikes out a line of its own, omits the Bustard and Crested Grebe, and casts the mantle of its protection over "Bulbuls" and "Teals" or ordinarily called "Divers," which, it assures us, breed from April 1st to November 1st.

Poona has a somewhat different list, including, under "other animals of game" a considerable number of quadrupeds. Birds and beasts alike are all protected from June 1st to October 15th of each year. The species are as follows, no scientific names being ascribed:—

Wild Birds—

Bustard.
Florican.
Peacock.
Common Sand Grouse.
Painted Sand Grouse.
Grey Partridge.
All species of Quail.
Cotton Teal.
Whistling Teal.
Courier Plover.

Other Animals of Game—

Hare.
Sambar.
Rib-faced or Barking Deer.
Mouse Deer.
Four-horned Antelope.
Indian Antelope.
Indian Gazelle.

Ahmednagar follows this list, except that its only "animal of game" is the ubiquitous hare.

The Malcolmpeth Municipality of Mahableshwar deserves special mention, if only for its attempt to protect the great majority of its bird-life, and for its original treatment of the hare. In Mahableshwar, "Wild Bird" includes all but the following:—

(i) Domestic Poultry.
(ii) Wild duck.
(iii) Snipe.
(iv) Quail.
(v) Birds of Prey.

It is to be hoped that either the first or the last of these exceptions can be so stretched as to cover our old friend "*Corvus splendens*." If not, he is protected, with the rest from March 1st till October 1st. The Sàmbar may not be shot between the 31st of May and the 1st of November ; the "Bhekar" between New Year's day and March 1st ; and other species of deer from the end of April to the beginning of December. The hare, in those lofty climes, is said to breed from September 30th till March 1st. Probably she does, and at all other periods of the year besides.

Belgaum Cantonment has a list of its own, which presents no striking features, except a certain vagueness of dates. Sind has many different lists ; protecting, in different places, most of the birds in the Ahmedabad list, with the local additions of Pigeons and Doves, Plovers and Paddy-birds. Like Belgaum it usually omits the hare. It shows no conspicuous variations in dates.

This practically exhausts the lists. It will be seen that the "sportsman" who desires to kill feathered game out of season can do so with impunity, provided that he keeps clear of Forest areas and does not bring his victims, when secured, within Municipal or Cantonment limits. If he picks his Municipality, even the restriction last mentioned is removed. Finally, with the exception of the hare in Mahableshwar and females in Forest limits, he may shoot anything that he can find, wherever he may be, between the 15th October and the 15th March of every season.

CORRESPONDENCE.

"THE PROTECTION AND PRESERVATION OF GAME IN INDIA."

No. 5740 of 1908.

General Department,
Bombay Castle, 19*th September* 1908.

To

The HONORARY SECRETARY,
Bombay Natural History Society.

Sir,—I am directed to forward herewith copies of a letter from the Government of India, No. 1848, dated the 14th August 1908, and the Bill accompanying it and to request that Government may be favoured with the opinion of your Society on the provisions of the Bill.

I have the honour to be,
Sir,
Your most obedient servant,
(Sd.) R. E. ENTHOVEN,
Secretary to Government.

(*Copy*).
No. 1848.

From

Sir HAROLD STUART, K.C.V.O., C.S.I.,
Offg. Secretary to the Government of India.

To

The CHIEF SECRETARY to the GOVERNMENT of BOMBAY.

Simla, *the* 14*th August* 1908.

Home Department.
Public.

Sir,—I am directed to refer to the correspondence ending with your letter No. 2739, dated the 19th May 1905, regarding the protection and preservation of game and fish.

2. The replies to the Home Department letter No. 1082—90, dated the 23rd May 1904, with which a draft bill was circulated, disclosed a strong consensus of opinion in favour of protective legislation, while indicating a considerable divergence of opinion on the principles of the bill. In the light of the criticisms offered and after a careful consideration of the whole matter the Government of India have arrived at the conclusion that the line of action originally contemplated should be abandoned, and that legislation of a very simple nature should be undertaken to afford protection to those wild birds and animals which are threatened with extermination.

3. A revised draft bill has accordingly been drawn up, and I am directed

to circulate it for the further criticism and opinion of local Governments. The revised bill defines game and takes power for local Governments to declare a close time during which it will be unlawful to capture, kill or deal in any specified kind of game or the plumage of any specified bird. Fish have been excluded from the scope of the proposed law, as their case can be suitably provided for by rules under the Indian Fisheries Act. The bill also provides a general exception in favour of the capture or killing of game in self-defence or in protection of crops or fruit, and gives power to local Governments to apply its provisions to birds other than those specified in the definition. It may be noted that clause 3 corresponds substantially to clauses 5 and 7 of the original bill, which were generally approved, and that clause 5 corresponds to clause 18 of that bill which also met with general approval. Clause 7 which applies only to birds is far less sweeping than clauses 2 (1) and 7 of the original bill. In short the present bill embodies in an improved and simplified form those provisions of the original bill which met with general acceptance. The Government of India consider that the proposed law will for the present be sufficient to restrict the indiscriminate slaughter of game, if it is combined with suitable restrictions imposed by rules under the Forest Acts in force in the different provinces.

4. The legislation contemplated is likely to be of limited application, as it is probable that in many parts of India the protection afforded by forests to species threatened with extinction will make it unnecessary to apply the measure, should it be passed into law. It may, however, be argued that the proposed bill, so far as it goes beyond the scope of the Wild Birds Protection Act, 1887, and especially in its application to deer and other animals which are liable to injure growing crops, is open to the objections stated in the Home Department Resolution No. 1471—81, dated the 29th August 1885. I am to request that these points of possible objection to the measure may receive the consideration of the Governor in Council and that the Government of India may be furnished with an expression of the views of His Excellency in Council on the scheme of legislation now formulated.

I have the honour to be,
Sir,
Your most obedient servant,
H. A. STUART.
Offg. Secretary to the Government of India.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

(*Copy.*)

A Bill to make better provision for the protection and preservation of game.

WHEREAS it is expedient to make better provision for the protection and preservation of game ; It is hereby enacted as follows :—

Short title and extent.

1. (*1*) This Act may be called the Indian Game Act 190   ; and

(2) It extends to the whole of British India, including British Baluchistan, the Santhal Parganas and the Pargana of Spiti.

Definition.

2. In this Act,—"game" means all kinds of the following birds and animals when in their wild state, namely—

(*i*) bustards, ducks, floricans, geese, jungle fowl, partridges, peafowl, pheasant, pigeons, quail, sand-grouse, snipe, spur fowl, and wood-cock :

(*ii*) antelopes, asses, bison, buffaloes, deer, gazelles, goats, hares, oxen, rhinoceroses and sheep.

Close time.

3. The Local Government may, by notification in the local official Gazette, declare any period of the year to be a close time for any specified kind of game throughout the whole or any part of its territories ; and, during such period and within the areas specified in such declaration, it shall be unlawful—

(*a*) to capture or kill any such game ;

(*b*) to deal in any such game;

(*c*) to deal in the plumage of any bird specified in such notification captured or killed during such close time.

Penalty for illegal capture or killing of, or dealing in, game.

4. Whoever does, or attempts to do any act in contravention of section 3, shall be punishable—

(*a*) on the first conviction with fine which may extend to fifty rupees, and

(*b*) on the second conviction with imprisonment for a term which may extend to one month, or with fine which may extend to one hundred rupees, or with both.

Presumption of commission of certain offences.

5. Where any person is found in possession of any game recently captured or killed, the Court may presume that he has captured or killed such game.

Savings.

6. Nothing in this Act shall be deemed to affect the capture or killing of game in self-defence, or in *bona fide* protection of a standing crop or growing fruit.

Application of Act to other birds.

7. The Local Government may, by notification in the local official Gazette, apply the provisions of this Act to any kind of bird other than those specified in section 2, which in its opinion it is desirable to preserve from extinction.

Repeal.

8. The Wild Birds Protection Act, 1887, XX of 1887, is hereby repealed.

To

THE SECRETARY TO GOVERNMENT,
GENERAL DEPARTMENT,
Bombay Castle.

6, APOLLO ST., FORT,
BOMBAY, *13th January* 1909.

SIR,—With reference to your letter No. 5740 of 1908, dated the 19th September 1908, I beg to forward herewith the opinion of this Society on the proposed Bill, " to make better provision for the protection and preservation of game."

I regret the delay that has taken place in forwarding the Society's opinion but the matter had to be referred to a Sub-Committee of ornithologists and others many of whom are stationed in other Presidencies, and it was only on receipt of these individual opinions that my Committee were enabled to formulate their views.

I have the honour to be,
Sir,
Your most obedient servant,
(Sd.) W. S. MILLARD,
Honorary Secretary,
Bombay Natural History Society.

BOMBAY NATURAL HISTORY SOCIETY.

The Committee of the above Society have considered with great interest the bill in which the Government of India propose " to make better provision for the protection and preservation of game ". In view of the importance of the subject to Members of this Society, the opinion of a Sub-Committee of some of the leading ornithologists and sportsmen in India has been obtained and this Sub-Committee, while approving generally of the bill, have made certain suggestions with a view to the more effective attainment of the objects that the Government of India have in view. We beg therefore to suggest the following modifications in the Clauses of the Bill founded on the opinions received, which we have the honour to submit to Government for their favourable consideration.

Clause 2.—Some alteration is in the opinion of this Society required in this clause.

(I). Should read " Bustards, (including florican), ducks (including teal), jungle-fowl, spur-fowl, pea-fowl, pheasants, partridges [including Snow-cocks (*Tetraogallus himalayensis*], Snow-Partridge, (*Lerwa nivicola*), Sand-Grouse, Painted-Snipe, Quail, Pigeons and Woodcock ".

The other snipe and Geese do not need to be included as they breed outside Indian limits.

(II). This part of the clause needs no alteration in our opinion.

It has been suggested that Wild Asses should be excluded from the provisions of this Act but it has recently been brought to the notice of our Society by H. H. the Rao Saheb of Cutch that these animals frequently stray from Cutch into British Territory where they obtain no protection.

Clause 3.—(*b*). This clause might include the "heads" or "trophies" such as skins, horns or hoofs.

(*c*). This Society would like to point out that in this clause no mention is made of the Herons (*Ardeidæ*) and Kingfishers (*Alcedinidæ*), the plumage of which is so greatly in demand in Europe, and they consider that special mention should be made of these birds.

Clause 4.—This clause should be made to include the confiscation of game heads, skins and other trophies as well as punishment for the offence.

Clause 6.—This clause should in the opinion of our Society have the following words added :—" but that the skins, heads or trophies of animals so captured or killed shall be handed over to the local authorities together with an explanation as to the reason of their being so killed or captured ". The inclusion of these words will, it is hoped, prevent native shikaris from shooting animals for trophies for sale under the plea of " protecting crops."

Clause 7.—This clause should in our opinion include any kind of 'animal' as well as 'bird'.

It is also the opinion of this Society that the results of this Bill will depend entirely on the working of it by the various Local Governments and it is partly with this idea that they suggest the inclusion of the above additions.

As naturalists as well as sportsmen, the Society would like to see the Bill extended to all Birds and Animals which are either harmless or useful to man, and protection not merely restricted to game, and they hope that the Government of India will be able to see their way to introduce such a bill at some future time.

W. S. MILLARD,
Honorary Secretary,
Bombay Natural History Society.

13*th January* 1909.

A LIST OF THE PUBLICATIONS RELATING TO THE ORIENTAL REGION.

FROM

THE "ZOOLOGICAL RECORD," 1906.

The list of publications given herewith has been compiled from the "Zoological Record" for 1906 and is in continuation of the previous lists which have appeared in previous volumes of the Journal. Formerly the list was confined to papers dealing with the Fauna of India, but in this one the whole of the Oriental Region has been included as it is considered that it will make it more useful, and to make the list as complete as possible, papers which have appeared in our own Journal have also been included.

COMPREHENSIVE ZOOLOGY.

Annandale, Nelson.—Notes on the Fresh-Water Fauna of India. No. V. Some animals found associated with *Spongilla carteri* in Calcutta. Calcutta, J. As. Soc. Beng., 1906 (187-196).

Annandale, N., and **Robinson, Herbert C.**—*Fasciculi malayenses* Zoology, part 3. Liverpool, 1906 (1-148, 1 pl.) 4 to.

Gardiner, J. S.—The Fauna and Geography of the Maldive and Laccadive Archipelagos, Suppl. ii, 1906 (1046-1077). [Completing the work.]

Gardiner, J. S.—The Percy Sladen Expedition in H. M. S. "Sealark" to the Indian Ocean. The Seychelles Archipelago. Nature, London, 1906 (294-296).

Gardiner, J. S.—The Indian Ocean. Being results largely based on the work of the Percy Sladen Expedition in H. M. S. "Sealark," Comm. B. T. Somerville, 1905. London, Geogr. J., 1906 (313-332 and 454-471).

Herdman, W. A.—Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar. With supplementary reports upon the marine biology of Ceylon by other Naturalists. Part V. London, R. Soc., 1906 (viii+452) 4 to.

Pavie, Auguste.—Recherches sur l'Histoire naturelle de l'Indo-Chine Orientale. Mission Pavie (1879-1895), 1904, Paris (E. Leroux), (549 a. pl.) 27 cm.

PROTOZOA.

Adie, J. R.—Note on a *Leucocytozoon* found in *Mus rattus* in the Punjaub. J. Trop. Med., London, 1906 (325-326).

Boinet.—Note sur le microorganisme du Bouton d'Orient á propos de la Communication de M. Billet. Paris, C.-R. Soc. biol., 1906 (1155).

Christophers, S. R.—*Leucocytozoon canis.* Sci. Mem. Med. Ind., Calcutta, 1906 (16, 1 pl.).

Dakin, W. J.—Report on the Foraminifera collected by Prof. Herdman at Ceylon in 1902. Rep. Ceylon Pearl Oyster Fish., 1906 (225-242, 1 pl.).

Laveran, A., et Mesnil, F.—Recherches expérimentales sur la trypanosomiase des chevaux de l'Annam. Comparison avec le Surra. Ann. Inst. Pasteur, Paris, 1906 (293-303).

Patton, W. S.—On a parasite found in the white corpuscles of the blood of palm squirrels, Sci. Mem. Med. Ind., Calcutta, 1906 (13, 1 pl.).

Ross. R.—Notes on the parasites of mosquitoes found in India between 1895 and 1899. J. Hygiene, London, 1906 (101-108).

Schulze, Franz Eilhard.—Die Xenophyophoren der Siboga-Expedition. Uitkomsten op zool., botan., ocean., geol gebied, verzameld in Ned. Ind. 1899-1900, aan boord H. M. Siboga, onder commando, van Lt. t/z le kl. G. F. Tydeman, uitgegevan door Max Weber. (Resultats des explorations zool. botan., ocean., geol. enterprises aux Indes Neerl. Or. 1899-1900. à bord du Siboga, sous le commandment de G. F. Tydeman, publies par Max Weber) Leiden (E. J. Brill), Livr. Monogr. 4 bis, 1906 (18, 3 pls.).

Schulze, F. E.—Die Xenophyophoren der amerikanischen Albatros-Expedition 904-05 nebst einer geschichtlichen Einleitung. Berlin, Sitzber. Ges. natf. Freunde (205-229, 1 Karte).

Vassal, J. J.—Trypanosomiase des chevaux de l'Annam. Ann. Inst. Pasteur, Paris, 1906, (256-295).

Porifera or Spongida.

Annandale, Nelson.—Notes on the Fresh-Water Fauna of India. No. I. A variety of *Spongilla lacustris* from brackish water in Bengal. Calcutta, J. As. Soc., Beng., No. 3, 1906 (55-58).

Annandale, N.—Notes on the Fresh-Water Fauna of India. No. V. Some animals found associated with *Spongilla carteri* in Calcutta. Calcutta, J. As. Soc., No. 5, 1905 (187-196).

Dragnewitsch, P. Spongien von Singapore. Reise von Dr. Walter Volz. Zool. Jahrb., Jena, Abt. f. Syst., 1906 (439-448).

Herdman, W. A.—Discussion of faunistic results. Rep. Pearl Oyster Fish., London, 1906 (433-449).

Coelenterata.

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MISCELLANEOUS NOTES.

No. I.—TIGERS AND THEIR PREY.

Twice lately I have come across an instance of a tiger killing a buffalo. In both cases the buffalo was not killed straight off, but was sufficiently damaged as to be unable to move and died where he was dropped, before the next night.

On both occasions the tiger must have known the animals were dying, but in spite of this never came back to see how they were getting on.

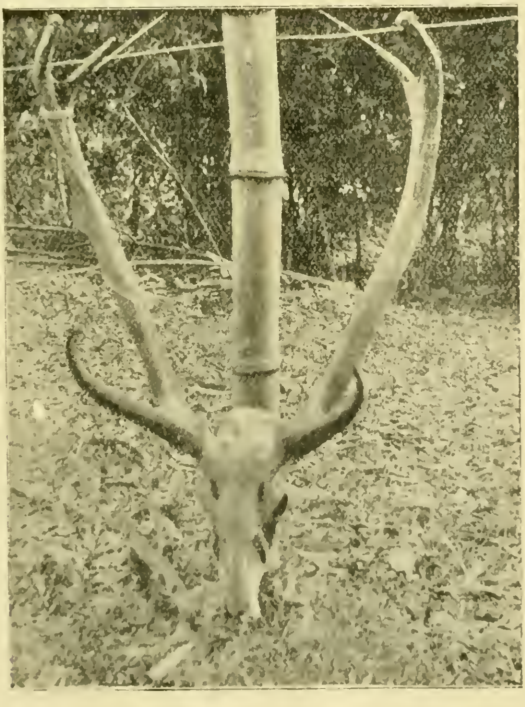
I am anxious to know whether it is the usual thing for a tiger to abandon a kill when the victim is not killed straight off—even though it is so badly damaged as to be unable to get away?

L. V. BAGSHAWE.

Pinteboo, Upper Burma,
October 1908.

No. II.—MALAYAN VARIETY OF THE SAMBHUR (*CERVUS UNICOLOR*).

The accompanying photograph of a Sambhur head of the *Malay* type, shot in the Kanbalu Sub-Division of the Shwebo District, may be of interest. The head is now in the possession of Mr. Millar of the Burma Railways.



The measurements are as follows:—

	Right.	*Left.*
Round burr	11 inches.	11 inches.
Above burr	9½ „	10 „
Length outside curve ...	34¼ „	35 „
Brow tines	15¾ „	14 „
Between tips...	22 inches.	
Widest span	26¼ „	

It is probable that the head would have exceeded these measurements but for the fact of the tips having been injured when in velvet.

H. S. DAVIES.

YEUANGYAUNG, U. B.,
2nd November 1908.

No. III.—WILD PIGS' LAIRS IN THE RAINS.

In the volume on Mammals in the Indian Fauna series it is stated that wild pigs make lairs for their young by forming a shelter of grass. The other day I came on several of these shelters, which had been abandoned, composed of dead branches and leaves. The Burmans who were with me told me that the pigs make these shelters in the rains and retire into them when it is raining heavily, moving about and feeding when the rain abates. There were about a dozen of these lairs in thick forest close together on the top of a small spur and it was evident that a herd had made the place their rains headquarters. The Burmans called them "Wetthaiks" or "Pigs' nests" and the name describes them very well. The shelters as I saw them were merely heaps of dried branches and leaves and had probably been in use this last rains.

H. R. BLANFORD,
A. C. Forests.

CAMP, MONYWA DIST., U. BURMA,
23rd December 1908.

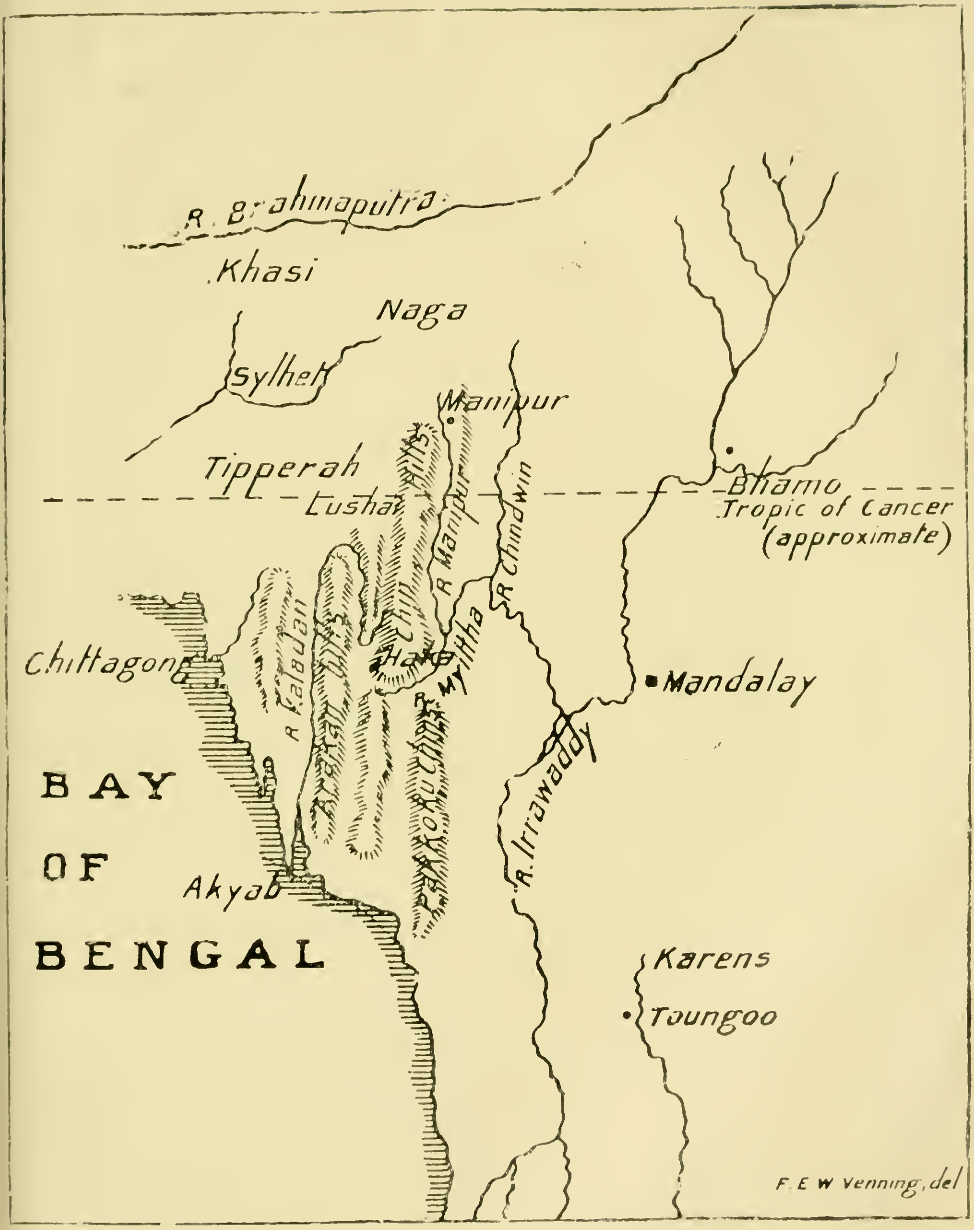
No. IV.—HABITAT OF CHINESE PANGOLIN (*MANIS AURITA*).

(*With a map.*)

I read with interest Major Wall's note under the above heading which appeared on pp. 678-9, Vol. XVIII of our Journal,

Blanford, "*Fauna of British India, Mammalia*", gives as habitat of *M. aurita* "Himalayas as far west as Nepal, at moderate elevations, Assam, hills north of Bhamo, Karennee, and Southern China (Amoz, Hainan, Formosa)"; and under *M. javanica* he writes "From Sylhet and Tipperah, and from lower ranges near Bhamo, throughout Burma, Cochin China, and Cambodia, the Malay Peninsula," etc. . . . and adds, "I have not been able to ascertain whether this species or *M. aurita* inhabits the hills south of Assam."

I attach a rough sketch map (very rough, I fear) of the part under consideration, a reference to which will show the distribution of the two species as


R. Brahmaputra
Khasi
Naga
Sylhet
Manipur
Tipperah
Lushai
Hills
R. Manipur
R. Chindwin
Bhamo
Tropic of Cancer
(approximate)
Chittagong
R. Kaladan
Arakan Hills
Chin Hills
Haka
R. Myittha
Pakokku Chins
R. Irrawaddy
Mandalay
BAY
OF
BENGAL
Akyab
Karens
Toungoo
F. E. W. Venning, del

ROUGH SKETCH MAP ILLUSTRATING DISTRIBUTION OF
MANIS AURITA AND *MANIS JAVANICA*
IN
BURMA AND ASSAM.

defined by Blanford. It would appear that *M. aurita* inhabits a tract of mountainous country extending from Nepal, through Assam (including the Naga hills, from which the specimen described by Major Wall came), through the hills north of Bhamo to Southern China ; and is also found as far south as Karennee. *M. javanica* meanwhile occupies the Malay Peninsula, Cochin China, Cambodia, Burma up to the lower ranges near Bhamo ; and is also found in Sylhet and Tipperah. Now it will be seen that between Burma proper and Sylhet and Tipperah there lie several ranges of mountains, namely : Arakan hills, Lushai hills, Chin hills, and Pakkoku Chin hills ; and the question at once suggests itself, is *Manis javanica* found in these hills ?

I put this forward then as a theory, that these are the hills referred to by Blanford in a general way as the "hills south of Assam" about which he expressed his uncertainty. In passing, it may be worthy of note that the localities assigned to *M. aurita* are all, with the possible exception of Amoy mountainous districts, lying about, but chiefly north of the Tropic.

My attention was first drawn to this subject when I was studying the intricacies of the Chin language by a curious superstition on the part of the Chins, according to which it is an exceedingly evil omen to meet a pangolin (sapú) by day. Of all Chin superstitions I regard this one as perhaps the most fully justified, the subject being as uncouth in appearance as it is rare to behold by day : thus furnishing another instance of the fact that man as a rule fears what he does not know and understand. For sometime my curiosity remained unsatisfied as to the nature of this dread creature only to be mentioned with bated breath, who lived under the ground where also the evil spirits live, who had a long nose, a long tail, was covered with scales, was armed with long claws and had withal a most baleful glance, but at length I discovered in a dictionary of the Chin (Lai) language that "suppu" (sic) was an "*armadillo*" ! Curiously enough the dictionary was not written by an American either.

To cut a long story short, on about 10th October 1908, a Chin came to my house with a fine male specimen of *M. aurita*, caught alive early the same morning in a cultivation near here [HAKA] at an elevation of about 6,000 feet above sea level.

Its dimensions, weight, etc., which I took very carefully, were as follows :—

* Length (from tip of nose to base of tail) 30 inches.
Tail length, 16 inches.
Circumference of tail at base, 11 inches.
Median fore claw, nearly $2\frac{1}{4}$ inches.
Median hind claw, less than 1 inch.
Largest scale, 2 inches in diameter.
Weight, 17 lbs.

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* This measurement was taken over the curve of its back while the animal was partially rolled up, which may account for its magnitude. Skins are, I think, very frequently misleading in measurements—sometimes stretching considerably and sometimes shrinking.

Total number of scales in vertebral row 49, of which* 17 or 18 were on tail.

Number of scales across back 17 rows, of which the outermost two or three rows were very obtusely keeled.

I tied it to a peach tree on the top of a small bank in my garden giving it a sufficient length of rope to allow it to get comfortably into the bank. It set to work at once to dig and I left it. When I returned I found it had slipped its rope and was out of reach under my flower bed ! I left it there for the night and then dug it out. It had burrowed horizontally a distance of about 10 feet. One evening I took it down to a small stream at the foot of my garden and it drank greedily and then to my surprise half waded and half swam across. I meant to have experimented further on its swimming powers, but that night it escaped and left its rope hanging over the bough of a small tree to the foot of which I had tied it. How it escaped is a marvel to me. I had tied its rope once round its body just behind its forelimbs tightly, then a separate loop round each shoulder tied in a knot again over its back ; and yet it had gone and the loops were left just as I had tied them. It had evidently had a pretty severe struggle to get free as most of the bark had been scraped off the tree. As a climber it was most agile and when once on a bough was very difficult to detach. It would roll itself into a ball round the bough, and even after its tail had been uncoiled by main force, it still clung on tightly with its long fore claws hooked over the bough and its stumpy hind feet pressed against it. This species did not walk as in the illustration of *Manis javanica* in Blanford's work referred to. It walked on the knuckles of its fore feet with the claws turned vertically up, not on the outer edge of the foot.

It would be interesting to get further information from Sylhet and Tipperah either as to the occurrence of both species from those localities or otherwise, and also from Karennee. I do not think that *Manis javanica* occurs near here as the Chins do not distinguish two kinds, but of course that is no criterion : and both species may occur.

Major Wall's specimen from the base of the Naga hills seems to preclude any theory as to *M. aurita* being a more mountain loving form.

F. E. W. VENNING.

HAKA, CHIN HILLS,
27th December 1908.

No. V.—THE JUNGLE CROW (*CORVUS MACRORHYNCHUS*).

The Jungle Crow (*Corvus macrorhynchus*), which in the Punjab and North-Western Frontier Province is a partial migrant visiting the plains only in winter and breeding from 6,000 to 12,000 feet, is normally abundant at this season in the plains of Bannu. Arriving suddenly about the end of October or beginning of November it leaves gradually from early in April to the middle of May and while with us replaces to a great extent the Common Crow (*C. splendens*) as cook house scavenger. This cold weather, strange to relate, the bird has not appeared.

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* It was difficult to decide which scale to consider the last on the body and which the first on the tail owing to the creature's propensity for rolling into a tight ball whenever touched or even approached.

With the exception of two solitary individuals heard and seen at two widely separated spots in the district I have not met with the species this winter.

On the other hand the Common Crow (*C. splendens*), the Hooded Crow (*C. sharpii*), the Rook (*C. frugilens*) and the Jackdaw (*C. monedula*) are all with us in their ordinary if not in increased numbers.

I am at a loss to offer any explanation of the Jungle Crow's failure to pay us his annual visit. Certainly the character of the weather from October to January can hardly be held responsible for this lapse on his part, for the weather has been, if somewhat drier than the average, nearly normal and the usual severe cold has, for the past 2 months or more, reigned in the hills of Waziristan Khost and on the Safed Koh range to the north-west. A circumstance perhaps tending to reduced numbers but which could not possibly have caused practically complete absence, as in the present instance, is de-afforestation in Waziristan.

The wooded hills of that territory, which borders Bannu on the west, are, much as it is to be deplored, being rapidly denuded of trees owing to the heavy demands for wood for building purposes in connection with military extension schemes. But this depletion so far is mostly among the deodar saplings which are required for rafters and scantlings. Mature trees in which the Jungle crow nests are of course also being cut down, but it is hard to imagine that with the primitive appliances in possession of the tribesmen and their want of organization there could, in one hot weather, take place such a wholesale felling of timber as to cause the birds to abandon their breeding grounds and desert the locality. Again a possible cause of reduced numbers might lie in the monsoon rainfall of the past year which was heavier than usual in the North-West Frontier Province and adjoining tribal territory and which may have destroyed many of the young nestlings. But this is only surmise and, as before, such a reason could not possibly be advanced to account for the complete absence of the birds from the district. The phenomenon, if non-appearance can be termed such, is a remarkable one and I can only trust that before the cold weather is over a solution of the mystery may be forthcoming. Possibly when the winter rains, which are now long overdue, break, the birds may come forth from their hiding places.

On the whole the autumn migration of 1908 in this part of India has been singularly inconspicuous in its manifestation. There was none of that great rush of the smaller passerine birds which was such a feature of the migration of the previous year, when individuals belonging to the families *Sylviidæ*, *Hirundinidæ* and *Motacillidæ* poured in thousands through the district on their way south. From Peshawar also Captain R. B. Skinner, R. E., informs me that few migrants were seen by him this autumn. And yet many of our winter visitors appear to be present in their usual numbers—notably the species of the family

Corvidæ already mentioned. Starlings, Lapwings (*Vanellus vulgaris*), Redshanks, Greenshanks, Green Sandpipers, Duck and Snipe. Curiously enough however the white-tailed Lapwing (*Chettusia leucura*) which generally leaves us for the winter, is also present in small flocks on our jhils.

While on the subject of migration I may observe that this corner of N. W India offers fine opportunities for the investigation of migration phenomena. Here systematic observation on the lines at present being carried out at home and on the continent should yield valuable additions to our knowledge of this difficult subject. The localities especially to be recommended for the establishment of migration observation posts are the Peshawar and Kurram Valleys.

Since writing the above, and just before posting this, I have come across a party of 5 or 6 crows feeding on the carcase of a dead camel. From a casual observation made at the time (being on the line of march) 2 or 3, if not all, of these were Jungle crows. But possibly there were some carrion crows among them.

H. A. F. MAGRATH, Major.

BANNU, *20th January* 1909.

No. VI.—NESTING OF THE LONG-TAILED GRASS-WARBLER (*LATICILLA BURNESI*) IN THE PUNJAB.

On the 23rd May I found a nest situated in the very middle of a clump of grass which I believe is called sarpat grass and is very common hereabouts. The nest was placed deep down close to the roots of the grass and was composed of dry blades of coarse grass lined with finer grass. The nest which was cup shaped measured externally 4″ in diameter and 2″ in depth and internally 2½″ in diameter and 1½″ in depth and contained 3 fresh eggs which corresponded exactly to the description of them given by Hume in "Nests and Eggs of Indian Birds."

The nest was extremely well concealed and I should never have discovered it had not the bird flown out as I brushed against the grass in passing. They are awful little skulks too and are past masters in the art of keeping a clump of grass between themselves and an observer. After this when I got to know their habits and where to look for them I found them in several other localities close to Lahore and always where there was this particular grass to be found. I noticed that each pair kept very much to themselves and only one pair inhabited each locality. The cock bird has rather a sweet song very much resembling that of the Yellow-eyed Babber but not quite so loud and rather short and jerky.

I also on 12th August came across a pair with fully fledged young ones and watched or rather heard (as they kept good cover the whole time) the old birds feeding them. During the process the old bird kept up a subdued warbling while the young one (presumably) kept up a continual note sounding like tic-tic-tic-tic-tic rapidly though softly repeated and prolonged as long as the old bird was in the vicinity.

On the 26th June I also came across a pair which were evidently on the point of breeding as the male was singing incessantly. This pair were not nearly so shy owing to the fact that the grass they inhabited was situated close to the Railway line within a few yards of which were coolies passing up and down all day carrying earth. The cock bird in this case let me approach to within 2 yards of the clump of grass in which he was singing and I watched him for several minutes so there can be no mistake about the song. It is the skin of one of this pair I am sending you. I came across six different pairs in different localities and should say that the bird is probably fairly plentiful but escapes notice easily.

A. J. CURRIE.

LAHORE, *6th October* 1908.

No. VII.—NOTE ON THE SLATY-BLUE FLYCATCHER (*CYORNIS LEUCOMELANURUS*) AND THE COMMON RUBY-THROAT (*CALLIOPE CAMTSCHATKENSIS*) IN TIRHUT.

To-day at Anarh Factory in the Darbhanga District my man brought me in a male of the Slaty-blue Flycatcher (*Cyornis leucomelanurus*) and also a male of the Common Ruby-throat (*Calliope camtschatkensis*). The former does not appear to be recorded from this part of India at all as Oates says *re* distribution :—"The Himalayas from Murree and Kashmir to Sibsagur and Sadiya in Assam ; the Khasi Hill ; Manipur ; Karence." Its occurring down here appears to me to be of considerable interest. The latter I mentioned in my "Birds of the Madhubani Sub-division" as having seen at Narhar but not got, so I am pleased to be able to authenticate its occurrence in this district. My man says that he saw two of the latter but he only got one.

CHAS. M. INGLIS.

LAHERIA SERAI, *31st December* 1908.

No. VIII.—THE RUFOUS-BACKED SPARROW (*PASSER PYRRHONOTUS*) NESTING IN THE PUNJAB.

On the 12th August I came across a colony breeding in a large field studded with acacia trees and situated on the banks of the Ravi.

The nests were in the acacia trees which were situated about 100 yards apart and each tree only contained one nest.

The nests, of which I found six, were of the usual sparrow type, untidy heaps of straw, and, with the exception of one, all had the entrance at the top, the egg cavity being reached by a more or less devious passage. On the 12th August one nest had 4 fairly well fledged young, one 4 fairly fresh eggs, and one had 2 fresh eggs (the full clutch in this case was five) and 3 more were empty. On the 20th August another nest had 4 fresh eggs and 2 were still empty and apparently deserted. The eggs are of the sparrow type, considerably smaller than the House Sparrows, and the description given by Hume fits them exactly. Of the three clutches I have, two clutches correspond to the second and one clutch to the third type described by Hume, but in each clutch there is one egg (and in the clutch of 5 there are two) which answer to the first type described by him. This is, I believe, what is usually found in clutches of House Sparrows' eggs, at least one very lightly marked egg which is usually also a trifle larger than the rest, occurring in each clutch.

The song of this bird consists of the usual sparrow chirrups interspersed with a note often repeated which exactly resembles the call-note of the Pied Wagtail, but whether this is the natural note or whether the particular bird I heard was mimicking the latter species, I cannot say. The birds appeared to feed on the seeds of the grasses growing in the field and during the heat of the day kept to the shade of the big trees which surrounded the field. I should be glad to know if either of these birds are known to occur in the Punjab.

A. J. CURRIE.

LAHORE, *6th October* 1908.

No. IX.—THE BLACK-CAPPED KING-FISHER (*HALCYON PILEATA*) IN THE THANA DISTRICT.

While shooting snipe on the north side of the Thana Creek near the Colsette Bunder on October 31st, I saw three Black-capped kingfishers amongst the mangrove bushes and shot one of them. This kingfisher appears to be a rare visitor to Western India confining itself almost entirely to the sea coast. Two examples have already been obtained near Bombay—one at Kalyan and the other at Revadanda in Kolaba District.

L. H. SAVILE.

PORT TRUST OFFICE, BOMBAY,
7th December 1908.

No. X.—NOTE ON THE CHINESE CRIMSON HORNED PHEASANT (*TRAGOPAN TEMMINCKI*).

In the last number of the Journal (Vol. xviii, p. 753) Mr. E. C. Stuart Baker establishes the claim of *Tragopan temmincki* to be included in the fauna of British India.

It is, however, entirely due to my own negligence that this species has not before been included in the list of Indian birds.

In 1903 I received a skin of an adult male of Temminck's Tragopan from Lieut. C. M. Macmullen who was then in charge of the military police at Sadône. He shot it at an elevation of 9,000 feet on the mountains south-east of Sadône in Burmese territory about a mile from the Chinese frontier. Lat. 25° 20′; long. 98°. There was snow on the ground at the spot where he shot this bird. The date was the 5th February 1903.

Mr. Macmullen informed me that the horns and flags of this specimen were of a bright, almost electric, blue.

It is clear that to Mr. Macmullon belongs the credit of first obtaining this species in a locality which is undoubtedly British Indian.

EUGENE W. OATES.

SAVAGE CLUB, LONDON,
24th December, 1908.

No. XI.—SARUS CRANE (*GRUS ANTIGONE*) IN SALSETTE.

I saw one Sarus Crane at Santa Cruz on the evening of the 9th inst. I have only seen these birds once before in Salsette and that was at Panwell in 1897, the famine year. It is, I believe, unusual to see one alone. A few days previously on the Bandra Railway Station platform I saw a dead Sarus which looked as if it had been shot, but as no one was near it I could not enquire whence it came. Perhaps this was the other one of the pair.

HEUGH S. SYMONS.

PALI HILL, NEAR BOMBAY,
11th December 1908.

No. XII.—OCCURRENCE OF THE LESSER FLORICAN OR LIKH (*SYPHEOTIS AURITA*) IN THE KONKAN, WESTERN INDIA.

A Lesser Florican (female) was shot by me near Panwell yesterday. I did not see its mate. About 20 years ago I shot a similar bird at Mahalaxmi. These are the only two birds of this species that I have seen below the ghats during my stay in Bombay.

HEUGH S. SYMONS.

PALI HILL, BOMBAY,
18th January 1909.

[Blanford says in Vol. iv.—Birds (*Fauna of British India*):—" Stragglers have been met with near Gwadar in Beluchistan and in Oudh and the N.-W. Provinces, Nepal, Bengal, Chutia Nagpur, Orissa (I once shot a bird not far from Cuttack) and on the Malabar Coast. One specimen is on record shot at Sandoway, Arrakan; but the bird is not found in Ceylon, nor, with the exception mentioned, is it known to occur east of the Bay of Bengal."—EDS.]

No. XIII.—OCCURRENCE OF THE SPOONBILL (*PLATALEA LEUCORDIA*) IN LOWER BURMA.

The following may perhaps prove of interest, as I think it is the first record from Burma.

On November 1st, 1908, at Kamigywe near Akyab, I shot a Spoonbill (*Platalea leucordia*). It was a young bird with black tips to the primaries, and a flesh coloured bill.

Since writing the above I have seen two parties of Spoonbills, in one case six and in the other about twelve birds. They were met with near where I killed the first bird and were seen on the 18th and 19th of December 1908.

J. C. HOPWOOD,
Dy. Consr., Forests.

AKYAB, L. BURMA,
16th February 1909.

No. XIV.—OCCURRENCE OF THE PEEWIT (*VANELLUS VULGARIS*) IN TIRHUT.

On several occasions I heard of birds which I took to be this species having been seen by my collectors and can now authenticate the occurrence of this species in this District. This is an interesting fact as Blanford does not mention it from Bengal at all.

This morning two birds of this species were seen by one of my men on a chaur some miles from here. He fired at both but only shot one. They were very wild and most difficult to approach.

In former years this chaur used to teem with bird life of all kinds, especially duck and teal, but this year besides these two lapwings, only one or two curlew (*N. arquata),* one great Black-headed gull (*Larus ichthyætus*) and a number of Brown-headed gulls (*L. brunneicephalus*) nothing else was seen. The ducks and storks were most noticeable by their absence.

CHAS. M. INGLIS.

LAHERIA SERAI P. O.,
17th December 1908.

No. XV.—THE LESSER FLAMINGO (*PHŒNICOPTERA MINOR*) IN CUTCH.

In the book published this year on the "*Indian Ducks and their Allies,*" I find it has been stated, as regards the Lesser Flamingo, in a quotation from Vol. vi. of '*Stray Feathers*', that, "we have no record of its occurrence in any other part of Jodhpore, or in Kutch, or in Kathiawar." It is further observed that "it is on the Sambhar Lake alone, perhaps, that it has, as a species by tself, been observed in any number in India." In reference to this, I would draw attention to the following remarks made by the late Major Lester, in the book (*The Birds of Kutch*) revised by him: "In May 1894, when on my way to England on leave, I crossed the Gulf of Kutch with H. H. the Rao in his steam launch, and, on nearing the Kathiawar shore, we saw large flocks of these handsome birds (*P. minor*) in very bright rose-coloured plumage, each bird being apparently all over of a pink blotting paper sort of colour." On the particular occasion here alluded to, my friend the late Major Lester and I were both together on board a steam launch when we saw the birds, and I have seen fairly large flocks of them on other occasions too in the same locality. Although the Lesser Flamingo is not common in Kutch, as the larger one is, it is at any rate a regular visitant in fairly large numbers to the inner Gulf of Kutch.

RAO KHENGARJI.

BHUJ, CUTCH,
26th December 1908.

No. XVI.—THE WHOOPER SWAN—A CORRECTION.

At page 13 of the book on "*Indian Ducks and their Allies*" there is a notice, as follows, of my having shot a *Cygnus musicus* (Whooper Swan) on the river Beas in the Hoshiarpur District on the 6th of January 1900 :

"While duck shooting with a friend on the river Beas on the 6th of January last, at a point opposite Talwara, in the Hoshiarpur District, we saw four wild Swans on the opposite side of the river. As there was no means of crossing, and the Swans were too far and too wary to be reached even by my four bore duck gun, we sent back to camp for our ·303 rifles. With these weapons we managed to secure one of the four. When we recovered the bird we found it to be undoubtedly a 'Whooper,' *Cygnus musicus*. Its weight and measurements were as follows:—Weight 12 lbs. (sic). Length from tip of bill to end of tail four feet eight and a half inches, spread of wing seven feet five inches."

Now there is a printer's mistake in the record of this bird's weight as noted in the mark quoted. My memory, and also a note in my diary, made at the time, tells me that this Whooper's weight was twenty-one (21 lbs.) pounds, and not twelve (12 lbs.). In printing the description from my manuscript account, the printer has evidently placed the figure "1" before the figure "2," instead of after it, making the weight "12" instead of "21" lbs. I see in "*Indian Ducks and their Allies*" page 13 the query "?" is placed after the weight given as "12 lbs.," and rightly so, but for my own credit I should like to have this mistake rectified in the next issue of the Society's Journal.

W. OSBORN, Lt.-General, I.A.

NAGGAR, KULU, PUNJAB,
1908.

No. XVII.—THE WHITE-WINGED WOOD-DUCK (*ASARCORNIS SCUTULATA*) IN TENASSERIM.

While touring last month in the forest country between the Attaran and Haungtharaw rivers, Amherst District, I came on three White-winged Wood-Duck (*Asarcornis scutulata*). I shot one, a fine drake, and as there appears to be some doubt as to this bird's occurrence in Tenasserim I am posting you the skin.

K. MACDONALD.

MOULMEIN, 25*th December* 1908.

[The skin proves to be that of a White-winged Wood-Duck (*Asarcornis scutulata*).—EDS.]

No. XVIII.—THE COTTON-TEAL (*NETTAPUS COROMANDELIANUS*) IN SIND.

On referring to "*Indian Ducks and their Allies*" I see that the Cotton-Teal has been definitely recorded once only in Sind and that no date is given.

I am now sending you, per registered parcel post, the skin and head complete of what I think is a Cotton-Teal (*Nettapus cormandelianus*) not in full plumage. I shot it at a jheel in Karidassas Sajawal, Karachi District, on December 27th. It was one of a bunch of 7 or 8 that came over me flying quite low and fast over the tamarisk bushes. If it is a Cotton-Teal, the incident may be of interest as an authenticated instance of the occurrence of the Cotton-Teal in Sind.

It has also been shot in Upper Sind, I believe, but I can get no definite details as to time and place.

R. E. GIBSON, I.C.S.

HYDERABAD, SIND, 29*th December* 1908.

[The skin sent is that of a Cotton-Teal (*Nettapus coromandelianus*).—EDS.]

No. XIX.—THE COTTON-TEAL (*NETTAPUS COROMANDELIANUS*) IN THE KONKAN, WESTERN INDIA.

As the occurrence may be of interest to record I thought you might like to know that I shot three Cotton-Teal (*Nettapus coromandelianus*) on a tank near Karjat which is in the Konkan just below the ghauts on the 10th inst. and did not see any others.

I send you a skin for identification.

B. BACON, CAPT.

KHANDALLA, 21*st December* 1908.

[The skin sent proves to be that of a Cotton-Teal (*Nettapus coromandelianus*).—EDS.]

No. XX.—OCCURRENCE OF THE PINK-HEADED DUCK (*RHODONESSA CARYOPHYLLACEA*) IN BURMA.

On the 25th December last, I shot a female Pink-headed Duck at Koolay near Singu in Upper Burma. Oates mentions 4 of these duck as being shot near Mandalay, but apparently they are rare in this country. I forward the skin for the Society's collection.

E. R. JARDINE,
Postmaster-General, Burma.

RANGOON, 20*th January* 1909.

No. XXI.—THE STIFF-TAILED DUCK (*ERISMATURA LEUCOCEPHALA*) NEAR NOWSHERA.

On 15th November I went down by boat from here to Attock. About a mile above Akora the Kabul River is very swift and the water much broken. Here I saw two ducks swimming very low on the water and which I at first took to be golden-eyes. We floated closer to them and they dived. One rose behind the boat out of shot, but the other went down stream. They kept under water a very long time (2 or 3 minutes, I should say). I fired at the one that had gone down stream and missed. It showed no desire to fly, but after being fired at, only showed its head and neck above water. I killed it and the other then came down stream, which I also shot. On collecting them I found out what they were and I skinned them next day. They were both immature Stiff-tailed Ducks—one male and one female (?). The male had a larger bill and longer neck. It measured 16½ins. in length, the female only 15½ins. I could not be sure of the sex, however, as they were both young birds and the female had no noticeable ovaries. They swam very low on the water, as I remarked, and I did not notice that they carried their tails erect. One bird when fired at rose and flew a couple of yards and took a regular "header" into the water. Bills—dark plumbeous, nearly black. Legs—Slate, with black markings. Iris—Sepia.

W. P. C. TENISON, LT., R. A.

NOWSHERA, 16*th November* 1908.

No. XXII.—CRUELTY TO WILD-FOWL IN THE PUNJAB.

In the cold season in the Punjab numbers of wild-fowl are captured by means of flight nets worked by native shikaris on the backwaters and tributaries of the big rivers and on the Jhils. In some parts, notably the Sikh Districts bordering the rivers Ravi, Beas and Sutlej, the unfortunate ducks when caught have their legs deliberately broken and the wing-quills twisted and tied in a knot over the back. In this miserable plight they are hawked about in baskets for sale in the villages and bazaars. I had ample evidence of this abominable practice when in the Punjab some 4 years ago and as far as I can ascertain it is still in vogue, in spite of the attention I endeavoured to draw to it some time ago in the public press.

H. A. F. MAGRATH, MAJOR.

BANNU, 11*th December* 1908.

No. XXIII.—LOCAL BIRD MIGRATION.

With reference to Mr. Dewar's article on "Local Bird Migration" in India which appeared on pages 343-356 of Volume XVIII (No. 2) of this Journal it might be interesting to know that I found a nest of the Red Turtle Dove (*Oenopopelia tranquebarica*) with three fresh eggs, on the 13th September, built in a low bush, 4 feet from the ground, also one being built on the 17th August in an acacia tree about 12 feet from the ground, and another on the 27th September about 8 feet from the ground. These are all very much lower than those I found in May and June which were generally in big trees 40 or 50 feet from the ground. It thus appears that this Dove has 2 broods a year here and is only partially migratory.

I also found on the 6th September an egg of the Pied Crested Cuckoo (*Coccystes jacobinus*) in the nest of a Common Babbler (*Argya caudata*). The Babbler's nest contained 3 slightly incubated eggs, the contents of all of which showed a faint trace of blood when blown, the Cuckoo's egg on the contrary was quite fresh. In shape it was oval, in size about twice as big as the Babbler's eggs and in colour a shade darker than the latter, its shell too was abnormally thick and to my mind there can be no doubt that it is the egg of a parasite.

A few days later in the same vicinity (*viz.* the banks of the Canal), I saw a full fledged Pied Crested Cuckoo being fed by a Large grey Babbler (*Argya malcolmi*) and on the 4th of this month (October) at Chenga Manga I also saw a young Cuckoo of this species following a party of Large grey Babblers. There can be no doubt therefore that both the Pied Crested Cuckoo and the Red Turtle Dove bred here this year as late as September, though the copious and protracted monsoon that we had here this year may have had something to do with it.

A. J. CURRIE.

LAHORE, 6*th October* 1908.

No. XXIV.—A NEW COLOUR VARIETY OF MACCLELLAND'S CORAL SNAKE (*CALLOPHIS MACCLELLANDI*) AND EXTENSION OF THE HABITAT OF THIS SPECIES.

Mr. Millard has submitted to me a very interesting specimen of this snake from Kasauli. Hitherto the species has only been known from the Eastern part of the Himalayas.

It constitutes a very distinct colour variety for which I propose the name *nigriventer*. It differs from *univirgatus*, the variety peculiar to the Eastern Himalayas, in having no trace of black rings, except on the tail where there are three, each being wholly imperfect on the left side. Further there is a continuous broad black irregularly outlined band, running down the middle of the belly. The snake is otherwise exactly similar to *univirgatus* in colour and lepidosis. The ventrals are 232, and the subcaudals 28.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

DIBRUGARH, ASSAM, 14*th October* 1908.

No. XXV.—NOTES ON TWO CASUALTIES FROM THE SAWSCALED VIPER (*ECHIS CARINATA*).

CASE 1.

Thanks to letters from Colonel Russell, R.A.M.C., and Mr. C. A. Owen, I am able to put on record an instructive case of *Echis* toxæmia which ended fatally.

The bitten subject was a muscular male European, aged 47, total abstainer, and non-smoker, and in excellent health. He was bitten at 10 a. m. on the 15th August 1908 at Rawal Pindi, wounds being inflicted on the fingers and back of the right hand and the back of the left hand. He went "at once" to the Station Hospital where the wounds were "freely incised" and crystals of permanganate of potash then rubbed in. Antivenene was then injected subcutaneously. He had no symptoms that day up till 5 p.m. when he left Hospital at his own request.

On the 16th at 6 p.m. his wounds began to bleed spontaneously, and he discharged blood in his urine, and by the bowel.

He was readmitted into the Station Hospital where his pulse, respiration, and temperature were found to be normal. His tongue however was swollen and discoloured, and his right arm too up to the shoulder. He passed blood in his urine, and also from the bowel. He was given internally Calcium Chloride, Adrenalin Chloride, and Ergot.

On the 19th he had severe vomiting necessitating feeding, and medication by the bowel, but his bleedings had reduced, and his general state was reported quite good. He complained only of pain in his hands.

He continued to improve, and the bleeding diminished until the 21st (the 7th day after the bites) no blood appearing then in the stools. At 4 p.m. that day however he suddenly collapsed, became delirious, and then comatose. He was given strychnia and other stimulants, and transfusion of salt solution was performed. Under this treatment he rallied temporarily, but a recurrence of the collapse at 10-30 p.m. culminated in death.

The case was thus a very typical one of viperine toxæmia. There were no symptoms at any time referrable to the nervous system, all the action of the poison being exerted upon the blood. The reduction in the coagulability of this fluid was responsible for the visible hæmorrhages, and there is no doubt but that the swollen and discoloured condition of the tongue, and the tissues in the right arm was due to subcutaneous hæmorrhages. The actual cause of death was obviously heart failure, due no doubt to the drain upon the system from continued and persistent bleedings. One could not expect beneficial results from antivenene in this case which was a wholly unsuitable one for the exhibition of this remedy. The serum prepared at Kasauli is only antitoxic to the venoms of the cobra and the daboia.

I have examined the snake that caused this fatality.

CASE 2.

I am indebted to Captain Fry, I.M.S., for the following:—A grass cutter was bitten at Lahore (date not recorded) in the finger by an *Echis* about 10½ inches long. He went to the Cantonment Hospital within an hour, and his wound was "deeply incised," rubbed with crystals of permanganate of potash, and allowed to bleed for an hour in a basin of hot water. 20 c. c. of antivenene were then injected subcutaneously. On admission he complained only of pain in the wound, but there was no local swelling. He was all right in an hour, and suffered from no after ill effects.

This case I regard as one of *Echis* bite not *Echis* toxæmia. It is very significant that there was no local swelling an hour after the accident, and from the absence of this symptom I feel justified in assuming that venom had not been injected into the wound.

The offender was identified by Captain Fry who reports that it had only small scales on the top of the head, an undivided anal, and subcaudal shields, and his diagnosis appears to me conclusive.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, 13*th December* 1908.

No. XXVI.—REMARKS ON SNAKE NOTES IN THE LAST JOURNAL (No. 4, VOL. XVIII.)

Flying Snakes. I cannot help suspecting that Major Beghie was mistaken in his identification of the snake he alludes to in Note XXIV. Firstly, *Echis carinata* is not a tree snake and very rarely climbs, and therefore I think would hardly be likely to have acquired the habit of springing from bough to bough, or from a twig to the ground. The fact that the snake is said to have been curled up in a figure of eight makes me strongly suspect it was a *Dipsadomorphus trigonatus*, as I have noted this peculiarity in this species, and in other tree haunting species. In vindication of Major Begbie's interesting note I think if the snake skin can be produced it would be well to submit it to our Society, to set at rest any doubts on the subject.

Abnormal specimens of *Zamenis mucosus* and *Dipsadomorphus trigonatus.*—A single loreal in the former species is certainly a rare deviation from the normal type. I am not aware that I have ever seen this.

The shield referred to with a query by Mr. J. P. Mullan in his figure of the Gamma snake is the upper part of a divided 2nd supralabial. The supralabials are not infrequently subject to a similar division in many snakes, and the tendency to division in certain species has become fixed or nearly fixed. Thus in some *Simotes* and *Coluber* the foremost supraocular touching the eye is normally divided, and constitutes what Mr. Boulenger designates (I think erroneously) a subocular. There is just as little justification judging from analogy for calling this a subocular, as there is for regarding the shield in Mr. Mullan's figure a loreal.

Kraits in Indore.—Mr. Cholmondeley rightly assumes the Krait he first speaks of in Miscellaneous Note XXVI as *walli.* I have examined one specimen which he sent to our Society's collection, and have no doubts as to its identity. This specimen and Mr. Cholmondeley's notes however call for a modification of some of my original remarks when describing the species. Thus the præocular white spot I found absent in my specimens is present at least some times. I noticed a *slight* tendency for some of the most posterior white arches to be paired in the specimen sent me by the Society. The "dirtier" colour beneath the tail tip is obviously a modification of the mottling I referred to in this region and I must admit that perhaps "mottlings" was a misleading word to use. The white is decidedly sullied with a suffused tint of slatish. In my original specimens I noted the tendency of the tail to subtriangularity in section though I omitted to record it. I hardly think however it was as pronounced as Mr. Cholmondeley shows it. The species is no doubt very close to *cæruleus* differing mainly in the scale rows numbering 17. I think too the narrowness of the 2nd supralabial as compared with the 3rd important, though subject to some variation in its degree. The specimen from Indore I examined was a deep black not mercurial-black as in my first specimens.

I take specimens A, B, D, E and F referred to by Mr. Cholmondeley to be *walli* without doubt, and specimen C a *cæruleus.*

From Mr. Cholmondeley's notes the range of subcaudals for this species is extended somewhat and from 17 records of specimens now known to me is 44 to 55. Indore as a habitat for the species extends its previously known range of distribution, but though Indore is perhaps not strictly speaking in the Ganges Basin it is to be noted that adjacent rivers flow into the Ganges.

Its extension to Indore again slightly modifies the remark in my book that *cæruleus* is the only krait found south of the Ganges.

Mr. Cholmondeley is to be congratulated on being the first to give us any information of the virulence of the poison of this krait, and his note is an extremely valuable contribution to krait literature. Would that we could acquire more.

Scientific nomenclature.—In Miscellaneous Note XXXIV Mr. Venning very rightly shows me in error in coupling the specific word *indica* with *Lygosoma* which as he observes should be *indicum*. Though it does not justify my error one whit, I am more reconciled to this exposure, in finding that others in a more exalted sphere than myself are occasionally guilty of likewise violating orthodoxy. Thus the very authority Mr. Venning quotes to substantiate his opinion has in his catalogue (Vol. III p. 554) *Lachesis gramineus.* Surely the Parcæ were females, and the specific title would therefore be more correctly *graminea*?

Erratum.—For *cinereoventer* on page 919, line 13, read *tephrogaster.*

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, *December 10th* 1908.

No. XXVII.—A CORRECTION—THE BUTTERFLIES—*PIERIS BRASSICÆ* AND *CANIDIA*.

Will you kindly inform me whether Fig. 43 *Pieris brassicæ* on page 170 of Vol. II. of Bingham's Butterflies (*Fauna of British India*), is an error for *Pieris canidia* as appears to me probable? For the fig. 43 certainly does not resemble the well known *P. brasscia* of England (and India) and I saw a species apparently identical with this figure and with the description of *P. canidia*—abundant above 8,000 feet at Naini Tal in October last. The female exactly resembles fig. 43 and I attach upper and under sides of the corresponding male on this letter for inspection,

It seemed to me that of the specimen taken by me the females were generally smaller than the males.

Were it not that *P. brassicæ* is so well known a species, I should, Bingham's book being so precise about details, &c., have presumed I was mistaken, and not have bothered you with this letter. But if the book has an error I would like to correct my copy.

It seems to me that the peculiarities of habits, flight and comparative alertness, protective resemblance, &c., of the various species, are even more interesting than the difference in marking, and it is just of these that books, especially that most exact and useful book, Bingham's—make little mention.

H. D. PEILE, I.M.S., CAPT.

FATEHGARH, *24th November* 1908.

[This mistake in the figure in Col. Bingham's book has been confirmed by Mr. Lefroy by reference to the Pusa collection, *Pieris brassicæ* does not have the series of black spots on the outer margin of the hindwing above as shown in the figure, which are present in *P. canidia*, and a careful comparison of Bingham's descriptions will confirm the fact. Workers who use this book will find it useful to correct their copies. Both species occur in the Himalayas but *P. brassicae* has the unusual habit of coming down to the plains and breeding there during March and April, it is recorded from Umballa and every few years is found in abundance in Tirhoot, where it breeds abundantly upon cabbage and other cruciferous plants. (Mem. Agric. Dept. India., Vol. 1, No. 2.)—EDS.]

No. XXVIII.—ON *TERACOLUS (COLOTIS) FAUSTA* AND OTHER SPECIES OF THE GENUS.

I am sending some specimens of *Teracolus* (*Colotis*) *fausta* taken in the neighbourhood of Karachi this year and would like to draw attention to a difference between the two sexes which is not mentioned in Col. Bingham's description in the *Fauna of British India, Butterflies* (vol. ii., p. 267). According to the latter the male may be distinguished from the female by

1. The absence of the sex-mark (specialized scales) in the fore wing.
2. In some forms a lighter colouring throughout.

In addition to these distinctions, however, I have noticed in the specimens obtained this year that

In the male the dorsal margin of the fore wing shows a pronounced curve, so much so that interspace forms a kind of lapet over the hind wing;

In the female there is no such curve, the dorsal margin being straight.

I have found this difference to be very constant among all specimens procured.

I also send a few specimens of *T. etrida* and *T. danae*, including some taken in 1904, which was an ordinary dry season in Sind, and some taken this year, which brought exceptionally good rainfall. The difference in colouring between the specimens of the two seasons is very pronounced. In his description of *T. danae*, Col. Bingham remarks "Male and female colouration very variable, especially in the female." I have sent you three specimens of females illustrating this, to which I would add that among a large series I find hardly two alike. In some of them the dusky margin is diffused over the whole of the apex of the fore wing and the crimson patch reduced to a few whitish streaks.

K. BERNHARDT.

KARACHI, 30*th October* 1908.

No. XXIX.—DESCRIPTION OF A NEW SPECIES OF *CHARAXES* FROM THE BHUTAN FRONTIER.

By G. W. V. DE RHÉ-PHILIPE.

Charaxes raidhaka, sp. nov.

Closely allied to *C. fabius*, Fabricius. Termen of fore wing more oblique and both termen and dorsum shorter than in *C. fabius*, giving the wing a narrower and more pointed appearance.

Upper side.—Fore wing ground colour a deep velvety black, darker generally than in the allied form; basal area greyish black. Immaculate except for a subterminal series of cream-coloured spots decreasing in size towards the apex: these spots larger and more marked than in *C. fabius*, those at the posterior angle being twice as large as in most examples of the latter. Hind wing, discal band as in *C. fabius*, but generally paler and narrower; subterminal series of light yellow spots complete, terminal markings greenish blue, not yellow.

Under side.—Ground colour a purplish grey, appreciably different from the usual ground colour of *C. fabius*. Markings arranged as in the latter, but the discal white bar on the fore wing obsolete and the sinuous black lines less defined. Ochreous red discal and purple submarginal lunular markings on hind wing large and distinct.

In regard to the outline of the fore wings, careful measurements of several males of *C. fabius* from different parts of India show the relative lengths of the costa, termen and dorsum to be in the proportions of 100 : 75 : 64 or 65 ; while similar measurements of the new form are in the proportions of 100 : 70 : 60. The difference in outline, though slight, is distinct.

The species is not represented either in the de Nicéville collection or in the Indian Museum collections ; nor is it described in Rothschild's "Monograph on the *Charaxes* and allied genera" (*Novitates Zoologicæ*, vols. v, vi and vii). It would appear to approach some of the Malayan forms of the genus ; except for the almost unmarked fore wing, the upper side is not unlike that of *C. echo* Butler, as illustrated and described in the above work.

Expanse 3·16 inches. Described from a single male taken near Jainti on the Raidhak River (Bhutan frontier), 2,000 feet, in June, and now in my collection.

[*The above is from the "Records of the Indian Museum," Vol. II, Part III, October,* 1908, *p.* 285.]

No. XXX.—MIGRATION OF BUTTERFLIES.

On Sunday, October 18th, I was spending the day in a small river-bed in the Ouchterlony Valley : it was a hot calm day with no appreciable breeze, at about 10 o'clock. *Euplœas* began flying high over the treetops—the river is in heavy forest—by thousands. They were floating over in their laziest fashion, all without exception, in the same direction, *viz.*, about due west, and kept this up until I left soon after 2 o'clock. It is impossible to estimate the numbers I could see passing over, but hundreds were in sight the whole time, so that tens of thousands must have passed over within sight during four hours. On the following Wednesday I was in the same place, but there was no sign of any such flight. The day was altogether cooler, and up till 11 o'clock, cloudy on the whole, with a good deal of wind at intervals. After 11 the sun shone almost continuously, but I hardly saw a *Euplœa* during the whole day. I mention this flight as I do not remember having seen *Euplœas* migrating in this manner, even on a small scale, before. There was none of the business-like aspect which a migration of Pieridæ always suggests ; they seemed rather to be going as slowly as they could, without any flapping of wings, and to be enjoying the sunshine rather than trying to get anywhere, though from the fact that they did not turn to the right or to the left, but kept a very exact course, it is to be supposed that they had some destination in view. With luck the earlier starters may have reached the Malabar border by nightfall, unless, as is possible, they were travelling in a circle.

H. L. ANDREWES.

BARWOOD ESTATE, NILGIRIS,
23rd October 1908.

No. XXXI.—SEXUAL ATTRACTION IN LEPIDOPTERA.

Some interesting notes on the above have appeared on pp. 511 and 923 of Vol. XVIII of the Journal. The following extract from a recently published book "Cornish Characters and Strange Events," by S. Baring Gould, M.A., which also bears on the subject, may therefore be of interest. The character being dealt with in the part of the book from which the extract is taken, is that of Mr. George Carter Bignell, born in Exeter in 1826, but residing (for he is still alive) at Saltash in Cornwall for the past fifty years, more or less. Mr. Bignell may be said to be a born naturalist, but those who wish to read more of his interesting career are referred to Mr. Baring Gould's book. The extract is a story told in Mr. Bignell's own words as follows :—

"I once had a virgin female of the Oak-egger moth and was desirous of getting some males. I started off with the lady in a tin box, with a perforated zinc top to give her air and allow her perfume to escape. I walked through the fields towards Mill-house to where was a turnstile, and at this spot lighted on a weary policeman resting. As it was a dull day, without any token of the sun breaking out to attract butterflies for their usual gambols, the policeman jeeringly remarked that I had missed the right day. I replied that I thought not, and that I could collect as many as I desired, in fact that I could make them come to me. He laughed incredulously. I then took out my tin box and placed it on the wall, and magician-like, whistled and waved my hand. The policeman stared and thought I was befooling him. But lo ! in two or three minutes one male alighted close to the box, soon followed by others, and in a quarter of an hour I had at least fifty, and so tame that I picked them up with my fingers and distributed them among about a dozen people who had gathered to see what I was about. The policeman stared with open eyes and mouth, quite satisfied that my whistle and mysterious signs in the air with my hand had called the insects to me. Satisfied with what I had got I waved again and bade the moths depart, and clapped the box in my pocket. Next day I took the empty box out with me into the country. I had several males following me, and some actually penetrated into my pocket where was the empty box, proving that the perfume still remained in it, though wholly imperceptible to myself."

The author prefaces the above story by stating that all moths with highly pectinated antennæ, that is to say with their feelers comb-like at the extremities, have the most extraordinary power of scenting a female moth at a great distance, even two or three miles with a favourable wind.

G. P. MILLETT,
Conservator of Forests, N.-C.

BOMBAY,
18*th January* 1909.

No. XXXII.—PEACH-LEAVES AS A SUBSTITUTE FOR LAUREL LEAVES.

I do not know whether peach-leaves, chopped up and bruised, have ever previously been used as a substitute for laurel, but I have just discovered that, treated in this manner, they give off an odour of prussic acid fully as strong, I think, as do laurel-leaves. I have tried the effect on a few insects and they were bowled over in a very short time, moths in a few seconds, and even a *Catharsius*, the large demy-beetle, in about 3 minutes. I have often regretted the absence of the laurel from this part of the world, and am pleased to find a substitute, as it will probably, like laurel, have the virtue of keeping beetles and other insects relaxed for days together, which the cyanide bottle does not do.

H. L. ANDREWES.

BARWOOD ESTATE, NILGIRIS, S. INDIA,
October 23rd, 1908.

No. XXXIII.—"DO ANIMALS DIE A NATURAL DEATH?"

In Volume XVIII., No. 2, Mr. Betham published a note under the above heading. By natural death, I take it, is meant death only due to the more common causes such as old age and incidental troubles, death by violence and epidemics being excluded. That wild animals do die from ordinary causes is inevitable but the problem is, what becomes of their bodies? This question has always had considerable interest for me, and from time to time as occasion arose I have made notes on the subject. The publication of Mr. Betham's notes re-opened the matter in my mind and leads me to think that perhaps my experiences may be of interest. Undoubtedly it seems rare for sportsmen or others wandering about jungles to come across the recent remains of animals that have presumably succumbed to natural causes. As mentioned above I am not speaking of those which have died from epidemic disease, as in Burma one may come across the remains of elephants dead from anthrax, or tsaing and bison that may have contracted rinderpest. I have seen instances of both, also of deer that have succumbed to a contagious malady. For very many years I cannot call to mind ever having run across a dead animal except a monkey, but on one trip accompanied by a friend I was singularly fortunate. We were wandering up the bed of a large stream, the part we were in being rarely frequented by men, when a noisome smell assailed us. There was a lot of what looked like wild alder bushs about and with the aid of the Burmans we soon discovered the cause—the carcase of a very fine wild dog (*Cyon rutilans*). The carcase was lying on its side on a flat rock, which was a little higher than the water, and surrounded by bushes. We were so interested that we looked carefully for any injury, but failed to find anything. The dog—a fine male—had been dead some few hours. Later on, the same day and in the same stream, another unpleasant smell forced itself on us. The cause this time turned out to be the carcase of a fine specimen of the Burmese Civet (*Viverra megaspila*). We could find no injuries about the animal. The remains were lying well hidden among bushes near water. The cat may have been dead some twelve hours or so.

The day following we were working towards the source of a side stream and came on the body of a bay squirrel (*Sciurus ferrugineus*) at the foot of a large tree. We concluded that he had probably died up the tree and the body had then fallen into the gully. The squirrel had been dead but a short time, being quite fresh. Some two or three days after while going up a deep nullah (a succession of cane brakes with a small amount of water) after a rhino, we came on the remains of a dead elephant (cow). We could find no bullet holes about the head or side, and wild animals had not touched it. The brake was a very thick one. I think it improbable that the animal had been wounded, as we were some thirty miles from the nearest village, though I am aware that an elephant unless mortally wounded may travel a long way.

On one occasion I saw a dead monkey. About half a mile from camp, one morning we came on a large troop of monkeys on the trees and bamboos by a stream. They were, as usual, chattering and jumping about but nothing extraordinary attracted our attention. We went on but having had no luck in the way of fresh tracks we returned to camp quite early and when nearing it found the camp followers, who had been out hunting for fish, crabs, tortoises, etc., endeavouring to remove a monkey from the midst of a thick clump of bamboos. The monkey was dead and the body in a sitting posture with hands clasped and the head resting on them. After much trouble we got the body down and found it to be that of a very old male (*Semnopithecus*) not at all in what one would describe as an emaciated condition, but nearly toothless. He had no injuries about him, just seemed to have run the limit, and from the patriarchal look on his face it is to be hoped that, in his latter days he spent his time in trying to inculcate some good in the monkey world, where there seems room for improvement. The story given me by the followers was that the monkeys were drinking when they saw them. As soon as the men were 'spotted' most of them had urgent business but some few remained and did not hurry. They noticed one that seemed very weak and could not go fast. These all went to a clump of bamboos not far off, climbed up, but soon after came down and ran off (I suppose after a tender but rather hurried farewell). Someone more inquisitive than the others went up to the clump and saw a monkey still there and alive, but he died shortly after. There was no doubt that the animal was not long dead, as the body was still warm. No monkeys were to be seen anywhere when we got there, and the place where we found the camp followers was only a few hundred yards distant from where we saw the monkeys in the morning. If monkeys are given to hiding their sick folk in dense bamboo clumps it is not surprising that we do not meet with many dead ones. Monkeys are plentiful enough in some localities.

My trackers showed me the remains of a cow elephant which they asserted died while trying to drop her calf. They stated the herd stood by for many hours, and a couple of days later they found the body of the cow.

I think it highly probable that wild animals know full well that the time is near at hand to seek fresh fields and pastures new, so instinctively they seek or are guided to some secluded spot not far from water where they can retire in peace and without much fear of molestation. Though hidden from vultures there are numbers of small mammals that may devour the flesh and also ants and other insects do their full share. The rains arrive in due course, all the nullahs become fast running streams, the water often overflows the banks, remains are washed away by the floods or are covered with sand, mud, etc. As a rule when the larger mammals have been shot on high ground and in more or less open places, the skeleton or parts of it will lie about for years, whereas when shot near streams, swamps, etc., a couple of years usually suffice to remove all traces except such bones as the lower and upper jaws, pelvis and femur. Burmans state that old bones are freely partaken of by most animals on account of the lime. It is certainly uncommon to find many antlers lying about on grounds where deer are plentiful.

It is also quite probable—as Mr. Betham suggests—that animals whose strength, through age or other cause, becomes impaired fall an easy prey to other animals who devour them. That this does sometimes happen is true—for instance the case of the very old Bison whose fine head is now in the Society's Museum. This old solitary bull was done to death by a pack of wild dogs. Perhaps too, old sambar, etc., are often disposed of by these brutes. The great puzzle always has been what becomes of the deer that live in open country which in many places over here is not frequented by carnivora. In Lower Burma, certainly, jackals are quite rare and I have never heard of a wolf being seen. An occasional panther or tiger might stray on such grounds, but I doubt if they stay long. Mr. Betham very pertinently asks where do blackbuck go to?—This is a mystery. I have asked natives if they ever came across blackbuck that had died, and this on certain grounds in Southern India where there used to be large herds, and also on the edge of the Bikanir desert where they abound (of course on the latter ground wolves and jackals are common enough and may snap up anything), but have always received a reply in the negative. I certainly have never heard of anyone who has picked up anything that could be identified as the remains of a blackbuck or chink. Mr. Betham asks "Has anyone ever come across vultures feeding on a dead wild animal?" If this remark alludes only to wild animals that have died a natural death I must answer no, but I have more than once followed up wild dogs after sambar and the first indication of the kill was occasionally two or three vultures, more often a couple of jungle crows. Of course I am referring to cases where kills have been in the open. When the dogs have been driven off the vultures and crows come for their share quickly enough. When cattle die in the open, one sometimes sees pariah dogs having a feed with the vultures and crows waiting patiently on the ground near by, but I have never noticed any familiarity of this sort when wild dogs were worrying a carcase.

G. H. EVANS, LT.-COL., F. L. S.

RANGOON, 26*th November* 1908.

NO. XXXIV.—THE FEAR OF MAN IN WILD ANIMALS.

There was a time when it would have been regarded as impious to suggest that man was not a specially created being, superior to all other forms of life, and in fact from the very beginning of all things on a different plane from the beasts of the field. He was not in former times included in works on natural history, and any suggestion of his connection with the anthropoid apes, or his descent by a collateral branch from a common original type would in the middle ages have in all probability been punished by burning at the stake. But we have changed all that. The discovery of the famous Spy and Neandorthal remains, comprising skulls of human beings of an inferior stage of cranial capacity; of the *Dryopithecus*, a highly developed form of extinct anthropoid ape, existent in the South of France in Miocene times, and perhaps an ancestor of man or a divergent branch from the same origin; and of *Pithecanthropus erectus*, the missing link, whose fossil remains have been discovered in Java; all these, taken in conjunction with the Darwinian theory of the origin of species, have led us to change our views, and to ascribe to man a primordial progenitor in no respect differing in kind from those of the so-called lower animals.

So long as man was looked upon as a type of the deity, possessed of inborn divine attributes, there is nothing surprising in his being termed the lord of creation, to whom was ascribed a subtle power over all other animals, which were supposed to be possessed of a natural fear of the image of God. But with the advance of science this verdict of our ancestors can no longer be accepted, and it is necessary that the question whether the so-called lower animals have any inherent fear of man, or not, should be investigated.

Facts do not bear out this presupposed psychic superiority of man. It has been found that in places where he has been hitherto unknown, man's presence is no more productive of dread in the animal world than is that of other living things. Thus, Darwin relates that in one island that he visited, the doves could be handled, and even attempted to settle on the heads of the human intruders. The great auk, now extinct, perhaps largely owing to its confiding nature, had no fear of man, nor have penguins and other birds in the more remote regions of the earth. The absence of timidity on the part of the American bison undoubtedly led to its practical extermination; whilst a similar fearlessness has been noticed on the part of whales, and in some places of the great seals known as sea-lions. The early mariners who braved the icy terrors of the Arctic seas encountered a profusion of animal life which regarded the presence of man with indifference: and Sir Harry Johnston discovered a similar tameness among the fauna of the dense primeval forests of Central Africa. The earlier visitors to the virgin hunting-grounds of Africa, during the first half of the last century, tell the same tale. Game that had not been pursued by the natives of the country and in remote and uninhabited regions, exhibited little fear of man. It is noteworthy that animals that are much hunted soon become wild and difficult to approach, whilst those that are not sought after, soon learn that they have nothing to fear from the aggressive character of man. The African elephant has always been hunted, and Mr. Selous tells us that "it will do everything in its power to avoid meeting a human being." With regard to the bonte-quagga the same writer says—"They are not naturally very wary, and in parts of the country where they have not been much disturbed, and are therefore unsuspicious of danger, they are very inquisitive. When hunting to the north of the Pungwi river in 1892, in a part of the country where I suppose the Burchell's zebras had never seen a man with any clothes on, these animals often came to within 100 yards to have a good look at me; and on one occasion a large herd approached within 50 yards, and after I had sat down on the side of an ant-keep, stood staring at me for about half-an-hour, and only ran off when I got up and walked towards them." He also relates how some of these animals fraternised with his horses. Again, he tells us with regard to the African buffalo—"Where they have never been hunted, buffaloes are unsuspicious of danger and easy to approach against the wind. Old bulls, indeed, will often almost refuse to get out of the way, but lie or stand gazing unconcernedly at the sight of a human being, until he is within 50 yards of them, while possibly one or other of a party of four or five will trot a few paces forward to get a better view." But when much persecuted the same animals soon become wary, and will desert their usual haunts in thick covert, and resort to open forests where they can obtain a good view, but must suffer considerable discomfort from the heat of the sun. Of the hippopotamus on the Umzingwani river, protected many years by LoBengula and his father, we are told that they became very tame and confiding and Mr. Selous says—"Where hippopotamuses have never been fired at, they are tame and even inquisitive. I once found a herd in a small rock-pool on the lower Umfuli river, the members of which had probably never seen a man with clothes on before, as they showed no fear whatever, but, as I sat on a rock on the edge of the pool, came up within a few yards, and remained with their heads in full view for a long time, staring stolidly at the unwonted sight."

In India it is more difficult to find unmolested animals. Here are no vast plains teeming with animal life, no forests untrodden by man where the wild beasts can wander in peace over trackless solitudes, such as those to be met with on the Dark Continent. But the same general rule obtains here also; that animals but seldom molested are comparatively tame, and soon become wild and wary when much hunted. I have found antelope and gazelle in remoter tracts, having but little fear of men, while elsewhere one cannot approach to within several hundred yards of them. I have seen gaur apparently almost as tupid as domesticated oxen, but in some localities there is no warier beast. Where the peafowl is sacred, it is as unfearing as the denizens of the farm-yard ; but in other parts of the country there are few birds more difficult to approach.

Perhaps the dread of man in the great carnivora is more difficult to account for than it is in other animals. It is remarkable, for instance, that a predaceous beast possessing the strength, activity, and armature of the lion or tiger should be cowed by the presence of a human being. But when they have once tried their strength against man, these creatures soon come to know that they have nothing to apprehend if they take him unawares. And although a small herd-boy may drive the ordinary tiger from his flocks, the man-eater soon becomes the terror of the country he infests ; while the wounded lion or tiger loses all fear of man. I have come upon a panther sitting quite unconcernedly by the side of the road upright on its haunches, looking at us, when I was passing with a number of men.

That animals left long unmolested in time lose their fear of man, would appear to favour the now generally accepted principle that acquired characteristics are not inherited. This principle is also supported by the fact that the young of wild beasts exhibit fear in a less degree than adults. It is also worthy of observation that the females of deer and antelope are frequently easier to approach than the males, perhaps because they are disregarded by sportsmen ; but this may be due to some inherent quality of natural feminine curiosity, found also in the higher animals.

Taking all the facts into consideration I think it must be accepted that there is no "natural fear of man," due to hereditary instincts in wild animals ; but that where such fear exists it is an attribute acquired during life as a result of experience and education.

The question of keenness of sight in wild animals, recently referred to on several occasions in this Journal, is perhaps to some extent connected with that of the fear of man. For where animals do not fear man, they will presumably appear largely indifferent to his presence. There are many animals, among them elephants and bears, notoriously deficient in keenness of vision. My own experience goes to show that the keenness of sight of wild animals has in many cases been much exaggerated, and that as a general rule wild beasts have not a keener vision than man. In some instances, as in the case of the ibex and other hill animals, an almost telescopic power of sight has been ascribed. But it is noteworthy how wild beasts will fail to distinguish a man, even at a comparatively short distance, so long as he remains motionless. They are very quick to detect movement, but after watching for sometime an object to which their attention has thus been directed, they will frequently resume their indifferent attitude. I must maintain my opinion that the sight of animals of the cat tribe is not keen ; this I have observed frequently in the case of tigers and panthers. Keenness of sight appears to be to a large degree a question of training, and animals exposed to constant danger are naturally quick to apprehend it, and to suspect it in any moving object. But they do not generally appear to be quick to define the outline of an object, and consequently its nature.

As regards birds, certainly the vulture and birds of prey are possessed of remarkable powers of vision ; for, unless it has a sixth sense, the vulture hunts by sight, as a concealed carcase will not attract these scavengers.

R. G. BURTON,
Major,
94th Russell's Infantry.

Khandalla,
November 1908.

PROCEEDINGS

OF THE MEETING HELD ON 12TH NOVEMBER 1908.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on Thursday, 12th November 1908, the Revd. E. Blatter, S. J., presiding.

NEW MEMBERS.

The election of the following 21 new members since the last meeting was duly announced :—

Mr. T. R. Lawrence (Bombay); Mr. A. R. Hunt (Betul, C. P.); Mr. J. E. Husbands, I.C.S. (Ahmednagar); Mr. H. W. S. Husbands, A.M.I.C.E. (Jalna); Mr. C. Somers-Smith (Seoni, C. P.); Mr. P. T. L. Dodsworth (Simla); Mr. C. H. Dracott (Quetta); Mr. H. F. Burke, R.A. (Bunji, Gilgit., Kashmir); Rev. H. W. Lee Wilson (Poona); Mr. R. J. D. Graham (Nagpur, C. P.); Mr. Edward A. Rooke (Sugdalpur, Bastar State, C. P.): Mr. H. C. Jeddere-Fisher (Satara); Col. H. Rose (Satara): Shah Zada Taley Mahomed Khan (Palanpur); H. H. Raja Bahadur Bhagvuntsinji of Orchha (Tikumgarh, Bundelkhund); The Principal, Punjab Agricultural College (Lyallpur, Punjab): The Superintendent, Government Horticultural Gardens (Lahore): Mr. A. Montgomerie, I.C.S. (Satara); Capt. W. Walker Browne, R.A.M.C. (England): The Librarian, Nizam's College (Hyderabad, Deccan); and Mr. M. H. Simonds (Jacobabad).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged the following contributions to the Museum since the last meeting:—

Contribution.	Locality.	Contributor.
1 Mottled Polecat (*Putorius sarmaticus*) ...	Quetta	Baluchistan Nat. Hist. Soc.
1 Quetta Vole (*Ellobius fuscicapillus*) ...	Do.	Do.
2 Ward's mouse hares (*Ochotona wardi*) ...	Kashmir	E. C. Stuart Baker.
1 Cashmir long-tailed field mouse (*Micromys sylvaticus griseus*)	Do.	Do.
2 Voles (*Microtus bachelix*)	Do.	Do.
7 Spiny mice (*Platacanthomys lascurus*)...	Charmadi, Mysore	R. Foulkes.
3 Mongooses (*Herpestes mungo*)	Cutch	H. H. the Rao of Cutch.
1 Madras tree-shrew (*Tupaia ellioti*) ...	Pachmarhi, C. P. ...	A. A. Dunbar Brander.
1 Markhor head (Kabul var.) (*Capra falconeri megaceros*).	Hurnai Valley, Quetta.	Capt. C. G. Woodhouse.
1 Oorial head (*Ovis vignei*)	Do.	Do.
3 Skulls of Andaman wild pigs (*Sus andamanensis.*)	Taken from a communal hut of the wild Jarva tribe at Pochang, S. Andamans.	J. E. Needham.

Contribution.	Locality.	Contributor.
4 Bats (*Cynopterus marginatus*)	Dilkusha & Cawnpore.	Major A. Begbie.
28 Bird skins including Raven, Wall Creeper, Black-throated Accentor, European Skylark, Striated Scops Owl, Hutton's Owlet, Lammergeyer, Long-legged Buzzard.	Quetta & neighbourhood.	Baluchistan Nat. Hist. Soc.
1 Black-capped King-fisher (*Halcyon pileata.*)	Thana	L. H. Savile.
73 Eggs of 22 species including Red-necked mountain finch, Adam's mountain finch, Severtzoff's rose-finch, Elwes's horned lark, Gould's chat, Black-necked crane, Bar-headed goose.	Gyantse (Tibet)	Lt. F. M. Bailey.
2 Inglis's Bush-quail (*Microperdix inglisi*).	Tirhoot	C. M. Inglis.
5 Birds	Thana Creek, Bombay.	N. B. Kinnear.
3 Sea snakes (*Chersydrus granulatus*)	Bassein, Thana Dist.	Capt. W. Glen Liston, I.M.S.
A number of snakes	Tongi, Burma	Capt. Lightfoot.
2 Snakes (*Callophis macclellandi, Zamenis mucosus*)	Kasauli	Col. Semple.
1 Water snake (*Tropidonotus stolatus*)	Madras	H. M. Dwane.
1 Cobra (alive)	Calcutta	E. O'Nash.
Several snakes (*Trachischium tenuiceps, Trachischium guentheri, Tropidonotus himalayanus, Coluber prasinus.*	Darjeeling	Major F. Wall, I.M.S.
1 Tree snake (*Dendrophis pictus*)	Bandora	G. Guidera.
1 Lizard (*Draco dussumieri*)	Nilgiris	A. M. Kinloch.
2 Lizards	Therawady, Burma.	E. G. S. Wood.
1 Chameleon	Bombay	A.B. Simkins.
1 Frog (*Rhacophorus malabaricus*)	Nilgiris	A. M. Kinloch.
1 Salamander (*Tylototriton verrucosus*)	Darjeeling	Major F. Wall, I.M.S
1 Cecilian (*Icthyophis glutinosus*)	Do.	Do.
1 Eel (*Muræna sp.*)	Persian Gulf	A. D. Burbridge.
A number of named Hymenoptera	Karachi, Nasik, &c.	E. Comber.
A number of butterflies showing dry and wet forms (*Teracolus etrida*)	Karachi	K. Bernhardt.
Petrified toredo borings	New dock, Bombay.	L. H. Savile.

Minor Contributions from :—General Osborn, Capt. Gillespie, Capt. O'Brien, Capt. Lightfoot, Messrs. J. E. Needham, H. B. Saxby, S. H. Prater, Jamsetjee (*Times of India* Press).

"THE POISONOUS SNAKES OF INDIA."

The Secretary announced that the *first edition* (2,500 copies) of "The Poisonous Snakes of India and how to recognize them" having all been sold, the Society had resolved to publish a *second edition*, and Major Wall had kindly agreed to bring the matter up to date. The first edition described only 33 poisonous snakes but 6 more had since been added and in the second edition 39 would be found described.

PAPERS READ.

1. A Cystic Worm found in the Common Cockroach, by Dr. N. F. Surveyor.
2. The Indian Doum (*Hyphœne*) Palm, by I. H. Burkill, M. A.
3. The Flying-fish of India. Do they fly? by G. F. Pollard, F.Z.S.

FLORA OF PANCHGANI.

The Rev. E. Blatter, S.J., read an interesting paper on "The Flora of Panchgani in October," and in the course of his remarks drew attention to a suggested experimental agricultural and horticultural station at Panchgani. He said :—"I should like to point out in this place the advantages of having an experimental station at Panchgani, not only for arboriculture but also for agricultural products. We are most of us aware of the wise policy of the Bombay Government during recent years in starting experimental agricultural and horticultural stations in different parts of the Presidency, and scientific agriculture on this side of India is still in advance of the rest of India, but it is not apparent why Panchgani with its particularly favourable climate has been passed over? The average rainfall is only 66 inches, whilst the altitude of 4,550 feet allows the place to enjoy a temperature similar to that of Mahableshwar, without any of its disadvantages.

Everybody knows that, in general, experimental stations have almost without an exception formed a part of the scheme, wherever the work of agricultural improvement has been taken in hand. The only question is where such stations are needed. There is not sufficient reason for establishing an experimental station in a certain district simply because, in theory, it is a good thing to have a place for trying experiments. The main consideration should be whether there is anything definite to learn, any particular question to solve, and whether this has any relation to the agriculture and arboriculture of the country around. If we can answer these questions in the affirmative an experimental station will be of practical value. When I speak of an experimental station I am not thinking of the more specially scientific experimental inquiries such as the finding out of new scientific truths or the testing of scientific theories by experiments on the nutrition of plants, the assimilation of different soil constituents or of atmospheric gases by plants, the exhaustion produced by continuous cropping, or the effect of extreme application of stimulating salts. I have in mind a more practical kind of experiment, such as the testing of the value of different processes already in use, the economical effect of various manurial ingredients upon particular crops, the collection of information regarding the outturn of crops, and especially the introduction and growth of new crops and fruit trees. Such inquiries will be for the benefit of the surrounding agriculture, supposing that the land chosen for the experimental station be composed of soil which is fairly typical of that of the country around, so that the result may be applicable to as large an area of similar land as possible. This is certainly the case with Panchgani. Its lateritic soil is practically the same as that of most of the surrounding hills. It is, besides, on the one hand, naturally not so rich as to call for no improvement, nor, on the other hand, so poor and sandy that no one would think of farming it. Improvement is certainly possible in this Presidency not only in the introduction of new varieties, but also in that of new economic species, whether these be entirely new to the country or merely new to the particular district. If we consider that various millets, maize, tobacco, tea, coffee, the potato and many other kinds of vegetables have been introduced into India, there is no reason why other species should not be imported also. As to Panchgani in particular, we can confidently say that, judging from the past 50 years, tangible results may be expected, if men with scientific knowledge and skilled in agricultural work would start an experimental station."

The paper will appear in full in the Society's Journal.

A vote of thanks having been passed to the authors of the different papers the meeting terminated.

PROCEEDINGS

OF THE MEETING HELD ON 14TH JANUARY 1909.

A meeting of the Members of the Bombay Natural History Society took place at the Society's Rooms on Thursday, 14th January 1909, Mr. R. Gilbert presiding.

The election of the following 29 new members since the last meeting was duly announced :—Mr. L. McIlwrick (Bombay) ; Mr. O. O'Donnell (Gonda) ; The President, Mess Committee, 1st Durham Lt. Infantry (Dilkusha) ; Mr. R. Scroggie (Mitkyina) ; Mr. S. F. Hopwood (Kindat) ; The Librarian, State Library, Hyderabad (Deccan) ; Mr. E. W. Graham Roe (Bombay) ; Mr. John Evershed (Kodaikanal) ; Mr. H. E. Mallandine (Srinagar) ; Mr. H. Tulloch (Bombay) ; The Principal, Bombay Vet. College (Parel) ; Major P. T. Cooper (Karachi) ; Mr. A. E. J. Croly (Amballa) ; Mr. E. J. Detmold (Daloo P. O.) : Mr. L. E. C. Everard (Mongnai) ; Mr. R. H. Beckett (Nagpur) ; Mr. R. C. Hobart, I.C.S. (Lucknow) ; Mr. F. Hannyngton, I.C.S. (Bareilly) ; Mr. W. H. Brymer (Maskeliya, Ceylon) ; Major N. A. H. Budd (Jubbulpore) ; Mr. E. H. Sullivan (Madnapalli) ; Mr. A. W. Keith (Gaya) ; Mr. F. C. Fraser, I.M.S. (Trichinopoly) ; Mr. A. C. Rogers (Belgaum) ; Mr. E. M. Duggan (Belgaum) ; Mr. H. W. Biggie (Dera Ismail Khan) ; Mr. L. S. Tollemache (Belgaum) ; Mr. H. D. Ash (Bombay) and Mr. A. T. Holme, I.C.S. (Oodeypore).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged the following contributions to the Museum since the last meeting :—

Contribution.	Locality.	Contributor.
Mountain Fox (*Vulpes vulpes montana*) ..	Chamba	Major G. S. Rodon.
Common Indian Mungoose (*Herpestes mungo.*)	Khandala	S. H. Prater.
9 Small Mammals (*Micromys sylvaticus pentax, Mus vicerex, Microtus wynnei*)	Bannu, N.-W. F. P.	Major H. A. F. Magrath.

Contribution.	Locality.	Contributor.
18 Small Mammals including an example of Whiteheads Stoat (*Micromys sylvaticus pentax*, *Microtus imitator*, *Microtus brachelix*, *Mustela whiteheadi*).	Bannu, N.-W. F. P	C. H. T. Whitehead.
25 Mammal skins including Bats, Moles, Voles, Squirrels and Rats.	S. W. China	Trustees of the British Museum.
14 Small Mammals	Murree	R. M. Adams.
1 Bat (*sp.* uncertain)	Karachi	E. Comber.
Curiously deformed Hyaena's feet	Khandesh	A.H. Simcox, I.C.S.
1 Spotted Crake (*Porzana maruetta*)	Bombay	J. C. G. Bowen.
1 Stiff-tailed Duck (*Erismatura leucophela*)	Nowshera	W. P. C. Tennison.
1 Do. do. do. do.	Sukkur	D. G. Ommanney.
1 Cotton teal (*Nettapus coromandelianus*)	Khandalla	Capt. B. Bacon.
1 Do. do. do do.	Karachi Dist.	R. G. Gibson, I.C.S.
Head and feet of Lammergeyer (*Gypaëtus barbatus*).	Wana	Capt. J. C. Simpson.
Water Rail (*Rallus aquaticus*)	Jhansi	C. Thornhill.
Water Snake (*Micropisthodon plumbicolor*)	Bassein	Capt. W. G. Liston, I.M.S.
1 Snake (*Lycodon aulicus*)	Madras	H. M. Dwane.
1 Snake (*Lachesis gramineus*)	Bombay	A. Simkins.
1 Tree Snake	Madura Dist.	Rev. J. E. Tracy.
1 Field Snake (*Zamenis fasciolatus*)	Salsette	R. W. L. Dunlop.
1 Sea Snake (*Enhydrina valakadien*)	Port Blair	Lt. Willock, R.I.M.
1 Lizard (*Eublepharis macularis*)	Rhotak, Punjab	Civil Surgeon, Rhotak.
1 Lizard	Bassein Fort, near Bombay.	A. Kirke Smith.
1 Tortoise (*Nicoria trijuga*)	Do.	Do.
Several Fish	Port Blair	Lt. Willock, R.I.M.
Several small Fish	Karachi	E. Comber.
2 Crabs	Do.	Do.
4 Crabs	Port Blair	Lt. Willock, R.I.M.
9 Echinoderms	Do.	Do.
2 "Sea Mice"	Do.	Do.
Several Butterflies	Khandwa, C. P.	D. O. Witt.
Several Hymenoptera	Various	E. Comber.

Minor Contributions from:— Major H. A. Magrath and Capt. Lightfoot.

EXHIBITS.

The Secretary drew the attention of the members to the tiger's head which had just been mounted for the Society by Rowland Ward. The specimen was presented to the Society by Major A. Stables, R.A.M.C. The head was greatly admired by all present.

The Revd. E. Blatter, S. J., said that it might interest members to know that a specimen of the Talipot Palm (*Corypha umbraculifera*) was to be seen at the present moment in flower on the north side of Elphinstone Circle Gardens. One of their members, Mr. R. Reeve, was the first person to draw the Society's attention to it and as it was apparently about 20 years since the last Talipot palm flowered in Bombay it was a most interesting event. Some members might remember that one of these palms flowered in the Grant Medical College Garden in 1885 and another at the foot of Malabar Hill about 1887. Mr. Mahaluxmivala mentioned that one of these palms was also now flowering in the Victoria Gardens, Bombay.

The following papers were then read :—

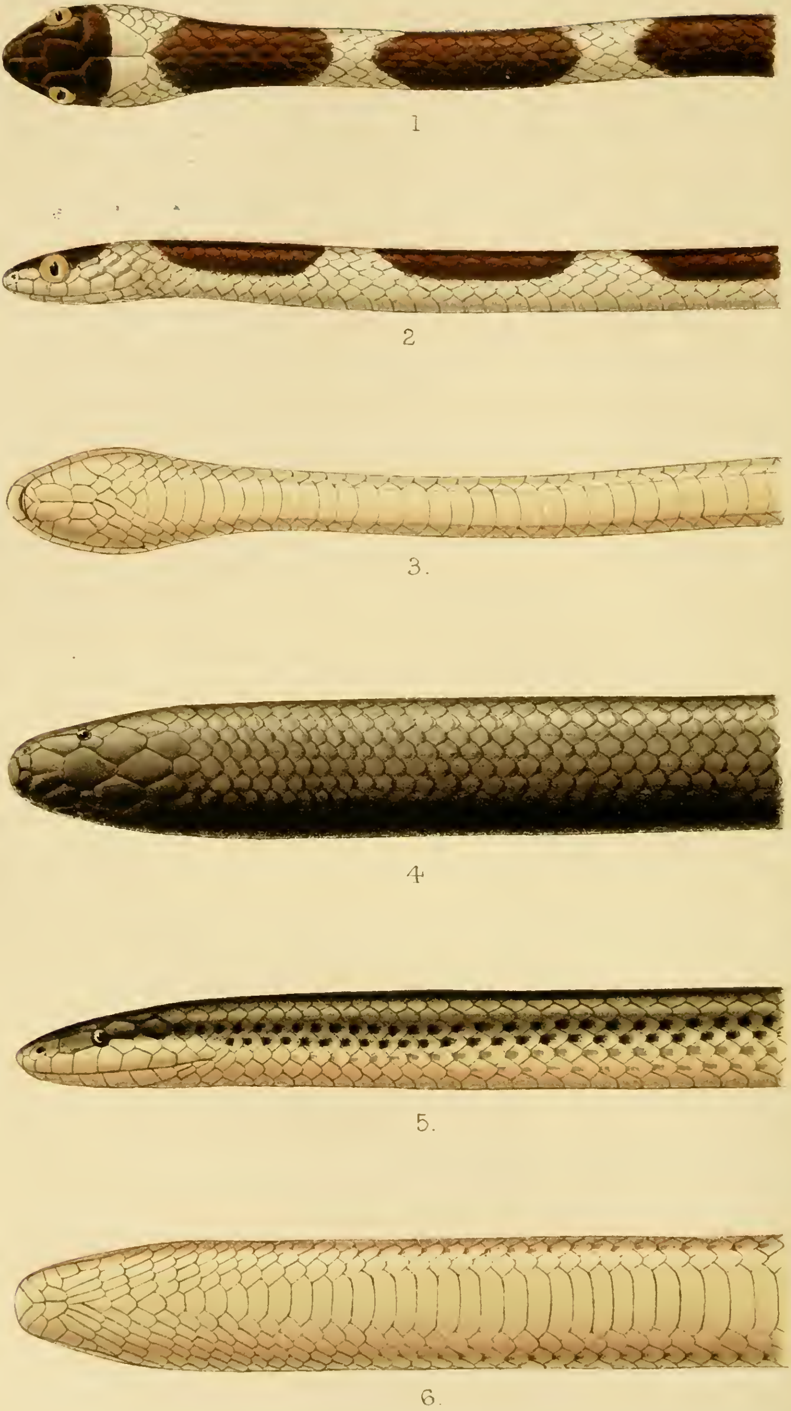
1. On airtight boxes and cases for Natural History specimens with experiments by Mr. John Wallace, C.E., with some remarks on the same subject by Mr. H. Maxwell Lefroy, M.A., F.E.S., F.Z.S.

2. Note on a new Alga (*Chara* sp.) found in Bombay Island, by Mr. Vinayak Nanabhai Hate, B. Sc.

3. The fear of man in wild animals, by Major R. G. Burton.

A vote of thanks was passed to the authors of the different papers, all of which will be published in the Society's Journal.

M34



J G del J. Green. Chromo

THE COMMON INDIAN SNAKES. (Wall).

1, 2, 3. Hydrophobus nympha, *harmless*. X 1.
4, 5, 6. Xenopeltis unicolor, *harmless*, X 1.

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JOURNAL
OF THE
BOMBAY

ERRATA.

Vol. XIX, page 130, for "*Andrena punjabensis*" read "*Andrena argada.*"
" 133, line 18, for "*M. albibrous*" read "*M. albifrons.*"
" 191, for "*Capra falconeri megaceros*" read "*Capra falconeri jerdoni.*"
" 257, line 7, for "(*C. frugilens*)" read "(*C. frugilegus*)."

to one of the species known from the Malayan Archipelago, *viz.*, *tristrigatus*. *Nympha* introduced by Daudin in 1803, is from the Greek νύμφη a bride, probably owing to the light coloured heads of the two specimens figured by Russell* in his first volume suggesting to his mind the nuptial veil worn by a bride.

(*b*) *English.*—The Bridal snake suggests itself to me as appropriate.

(*c*) *Vernacular.*—The only name I can find is that used by Russell, *viz.*, "Katla vyrien."

Dimensions.—I have seen two specimens measuring 1 foot 8 inches and this is the greatest length known to me.

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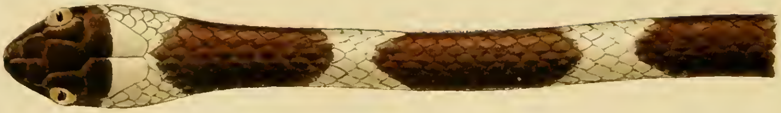
* Ind. Serp. Plates XXXVI and XXXVII.



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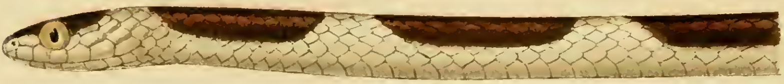

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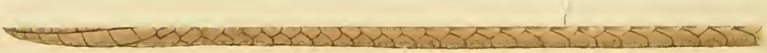

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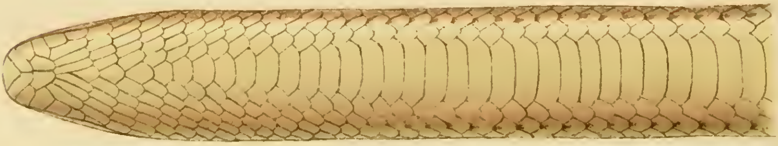

6.

J G del J.Green.Chromo

THE COMMON INDIAN SNAKES. (Wall).

1,2,3. Hydrophobus nympha, *harmless.* X 1.

4,5.6 Xenopeltis unicolor. *harmless,* X 1.

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A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

BY

Major F. Wall, I.M.S., C.M.Z.S.

Part X with Plate X and Diagram 1.

(*Continued from page* 106 *of this Volume.*)

The Bridal Snake (*DRYOCALAMUS NYMPHA*).

Synonym, *Hydrophobus nympha*.

Nomenclature. (*a*) *Scientific.*—The generic name from the Greek δρυς a tree and καλαμος a reed, was first applied in 1858 by Günther to one of the species known from the Malayan Archipelago, *viz.*, *tristrigatus*. *Nympha* introduced by Daudin in 1803, is from the Greek νύμφη a bride, probably owing to the light coloured heads of the two specimens figured by Russell* in his first volume suggesting to his mind the nuptial veil worn by a bride.

(*b*) *English.*—The Bridal snake suggests itself to me as appropriate.

(*c*) *Vernacular.*—The only name I can find is that used by Russell, *viz.*, " Katla vyrien."

Dimensions.—I have seen two specimens measuring 1 foot 8 inches and this is the greatest length known to me.

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* Ind. Serp. Plates XXXVI and XXXVII.

Bodily configuration.—The body is cylindrical, slender for its length, and very uniform in girth throughout, perhaps suggesting the form of a reed used in the generic title. The head is moderately flattened, the snout moderately rounded, and the neck evident. The eye is rather large and the iris colourless, so that during life the shape of the pupil which is vertical cannot be seen. The nostril is small. The tail is rather short, being about one-fifth the total length. The belly is strongly angulated on either side. The whole snake is smooth and glossy.

Colour.—Dark-brown or black above, fading somewhat posteriorly with from 35 to 50 conspicuous white or yellowish cross bars in the whole length of the snake. These are most conspicuous anteriorly where they involve 2 or 3 scales vertebrally and are more widely separated there than behind. Frequently they are not pure white or yellow, but sullied more or less with a brownish mottling or speckling. In the young they are usually yellow, and often but not always tend to grow whiter with age ; those shown in our Plate being remarkably white. The head in the young is yellow or suffused with yellow which tends to become more localized with age and form a more or less conspicuous band on the back of the head. The under parts are pearly-white, creamy, or yellowish throughout and unspotted. It is a very handsome and graceful little snake, the specimens marked with pure white as in our plate being remarkably attractive.

Identification.—(1) The scales are in 13 rows in midbody. (2) The præfrontal besides touching its fellow and the frontal is in contact with 5 (or 6) other shields, *viz.*, the internasal, postnasal, loreal, one or two præoculars and supraocular. (3) The loreal touches the eye. There can be no doubt of its identity if these points are sought for in the order above given and are found to co-exist.

Haunts.—My knowledge of the Bridal Snake, though very limited, points to haunts and habits closely akin to that of the Common Wolf-Snake. The first I encountered was in a house on the banks of the Chilka Lake. Sitting after dinner in a room on the ground floor I saw it moving beneath the chair of a friend. I ran for a stick and tried to kill it, believing it to be a young krait. Had the stick been a flexible cane I would probably have despatched it with the first blow, but I made several ineffectual attempts to strike it, the stick making an angle with the floor passing over it each time. The reptile thoroughly scared added to my difficulty by its agile movements. When at length it was wounded I would not pronounce upon its identity by lamp light, the gloss on its scales making their detail uncertain, but I felt sure I had been dealing with a krait until the morning light showed me mistaken.

Disposition.—My knowledge of this species is so limited that I cannot speak of its disposition, habits, food or breeding. The smallest specimen I know of is one mentioned by Günther which was 6¼ inches (75 lines) and I should think probably a hatchling.

Distribution. (*a*) *Geographical.*—South India, Orissa, and Ceylon. All the British Museum specimens are from Ceylon and South India. Jerdon speaks of it from Madras, Ferguson from Travancore and I have had two specimens from Orissa (Rumbha and Berhampore), two from Trichinopoly, and one from Madras. The exact localities in Ceylon of the British Museum specimens except Trincomalee are not noted. Haly* says that 5 specimens in the Colombo Museum are from Jaffna, and Willey † only mentions Jaffna and Anuradapura. Ferguson‡ speaks of one from the South part of the Island without specifying further. This is in the British Museum now, *viz.*, specimen *T* of Boulenger's Catalogue (Vol. 1, p. 371).

(*b*) *Local.*—Appears to be chiefly a snake of the Plains, but there are British Museum specimens from the Nallymally, Balarangam, and Cuddapah Hills, altitudes not recorded.

(*c*) *Numerical.*—I would call it rather an uncommon snake in India, having only collected 5 specimens. Ferguson mentions but two specimens in the large collection at Travancore. Jerdon, however, says it is not rare at Madras.

Lepidosis. Rostral.—Touches 6 shields, the rostro-internasal sutures rather longer than the rostro-nasal. *Internasals.*—Two; the suture between them about three-fourths to equal to that between the præfrontal fellows, about half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two; the suture between them subequal to or rather greater than the præfronto-frontal; in contact with the internasal, postnasal, loreal, one or two præoculars, and supraocular. *Frontal.*—Touches 6 shields; the supraocular sutures longest, twice or nearly twice the parietals which are rather the smallest. *Supra-*

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* First report, Snakes, Colombo, June 1886, p. 10.

† Spol. Zeylan, April 1906, p. 233.

‡ Rept. Fauna, Ceylon, 1877, p. 19.

oculars.—Length subequal to, breadth about half that of the frontal. *Nasals.*—More or less divided, or entire and simply perforated by the nostril; in contact with 1st and 2nd labials. *Loreal.*—Single, longer than the nasals, about twice as long as high, touching the eye. *Præocular.*—One, intervening between the loreal and the supraocular. *Postoculars.*—Two. *Temporals.*—Two. *Supralabials.*—7, the 3rd and 4th touching the eye. *Infralabials.*—5, the 5th largest, nearly twice as broad as the posterior sublinguals; in contact with 3 scales behind; the first meet to form a suture half or less than half that between the anterior sublinguals. *Sublinguals.*—Two pairs; the posterior two-thirds to three-fourths the length of the anterior: in contact with the 4th and 5th infralabials. *Costals.*—Two heads-lengths after head 13, midbody 13, two heads-lengths before the anus 13; vertebrals not enlarged, last row not or barely enlarged; not keeled; apical pits present, single. *Ventrals.*—200 to 243* (Boulenger); markedly angulate on each side. *Anal.*—Divided. *Subcaudals.*—65 to 88 (Boulenger), divided. *Anomalies.*—Rarely there are two præoculars. The supralabials are sometimes 6 or 8. In one of my specimens the 10th to the 14th subcaudals were entire.

Two other species of *Dryocalamus, viz.*, *gracilis* and *davisoni*, occur within Indian limits. The former should, I think, be noticed here being very like *nympha* in colouration and therefore likely to be confused with the krait. The latter is not like the krait, being striped in a longitudinal direction and is a Malayan snake which just enters our limits in Tenasserim. I shall therefore make no remarks upon it.

THE SCARCE BRIDAL SNAKE (*DRYOCALAMUS GRACILIS*).

Nomenclature. (*a*) *Scientific.*—The specific title (Latin = graceful) was given by Günther in 1864, in allusion to its graceful form. Like its ally *nympha* it is a very attractive little snake, striking in its dainty colouration and slender outline.

(*b*) *English.*—The Scarce Bridal Snake, would, I think, be a fitting designation.

(*c*) *Vernacular.*—It is too uncommon to have been christened in any native dialect.

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* There is a decided tendency for these shields to be more numerous in Indian than in Ceylon specimens. Thus in 6 Ceylon examples they range between 200 and 219, and in 19 Indian examples between 216 and 243.

Identification.—If the following points are sought for in the order herein given, there can be no mistake in recognising it. (1) The scales in the middle of the body are in 15 rows. (2) The præfrontal besides touching its fellow and the frontal meets 5 other shields, *viz.*, the internasal, postnasal, loreal, præocular, and supraocular. (3) The loreal touches the eye. (See outline figure Diagram.)

It is a much more uncommon snake than *nympha*, there being but two examples in the British Museum both of which I have examined. I collected two others at Berhampore in Orissa, and have seen a fifth in the Indian Museum which was referred by Sclater to its ally *darisoni*. This is recorded doubtfully from False Island, Arrakan, a most unlikely locality for it to have been collected in. The British Museum specimens are from the Anamallay and Cuddapah Hills. The only other specimens I know of are two recorded from Ceylon by Haly,* one of which he described as a distinct species under the title *fergusonii*. One of my specimens fell from a verandah roof one evening after dinner into the middle of a family circle. It was captured and sent to me, and at first sight I took it to be a young krait. The longest specimen I know of is one of mine which was 1 foot 11$\frac{7}{8}$ inches.

Lepidosis. Rostral.—Touches 6 shields, the rostro-internasal sutures rather longer than the rostro-nasal. *Internasals.*—Two; the suture between them from three-fourths to equal to that between the præfrontal fellows, equal to or rather less than the internaso-præfrontal sutures. *Præfrontals.*—Two; the suture between them three-fourths to equal to the præfronto-frontal, in contact with the internasal, postnasal, loreal, præocular and supraocular. *Frontal.*—Touches 6 shields, the supraocular sutures longest, nearly or quite twice the fronto-parietals. *Supraoculars.*—Length subequal to, breadth about half that of the frontal. *Nasals.*—More or less divided, in contact with the 1st and 2nd supralabials. *Loreal.*—One, rather longer than the nasals, twice as long as high; touches the eye. *Præocular.*—One. *Postoculars.*—Two. *Temporals.*—Two. *Supralabials*— 7; the 3rd and 4th touching the eye. *Infralabials.*— 5, the 5th largest, and in contact with 2 or 3 scales behind. The suture between the first about half that between the anterior sublinguals. *Sublinguals.*—Two pairs; the posterior rather shorter than the anterior, in contact with the 4th and 5th infralabials. *Costals.*—Two heads-lengths behind the head 15, midbody 15, two heads-lengths before the anus 15; the vertebrals not enlarged; ultimate row not or barely enlarged; no keels; apical pits present, single. *Ventrals.*—199 to 243, angulate laterally. *Anal.*—Entire. *Subcaudals.*—75 to 87; divided.

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* Taprobanian III, 1886, p. 51.

Anomalies.—The specimen in the Indian Museum above referred to has the anal divided. The costals vary in individuals. The Anamallay specimen in the British Museum has 13 scale rows for a considerable distance anteriorly, and the Cuddapah Hills specimen in the same Institution 13 for some distance anteriorly and posteriorly. Where the rows are 13 that next to the vertebral is unusually large owing to a confluence of two rows. When the rows reduce again from 15 to 13, the row next to the vertebral coalesces with that below.

The Iridescent Earth Snake (Xenopeltis Unicolor).

Nomenclature. (*a*) *Scientific.*—The name of the genus was introduced by Reinwardt in 1827, and is from the Greek ἐὺοε strange, πδλτή a shield, in allusion to the unusual disposition, and number of the shields on the top of the head, many of which are quite peculiar to this snake. The specific name was also given by Reinwardt and refers to the uniform dorsal colouration.

(*b*) *English.*—The Iridescent Earth-Snake is the best name for it, the beautiful play of colours seen in the dorsal black on reflected light calling for special remark.

(*c*) *Vernacular.*—I know of none.

Dimensions.—It grows to four feet. A specimen which Evans and I collected in Rangoon measured 3 feet 5½ inches, and Colonel Evans has had one 4 feet 1 inch long.

Bodily configuration, etc.—The body is of remarkably uniform girth in its whole length, and broader in its lateral diameter than in the ventro-vertebral. The head is spatulate, the snout broadly rounded, and the head merges into the body without indication of a neck. The eye is remarkably small and the iris very dark so that the pupil is with difficulty discerned in life. When scrutinised closely the iris is seen to be dark-brown in colour, and the pupil vertically elliptical. The nostril is small, the tail is decidedly short, measuring from about one-tenth to one-eleventh the total length of the snake. The whole snake exhibits an unusually high polish to its scales.

Colouration.—One of the most remarkable characters of this snake which is remarkable in so many ways, is the brilliancy of the iridescence seen on its scales when the light is allowed to glance on them. Flower * thus remarks upon it: "The iridescent colours of this snake are most beautiful, and wonderful. As it crawls along, the curves of its body flash brilliant lights of emerald-green, copper, blood-red, purple and electric-blue, while the actual colour is a very dark rich coffee-brown." The specimens I collected in Burma were black or blue-black rather than brown. The last three costal rows are more or less heavily margined with whitish, the last often uniform whitish. The young are coloured similarly except that they have a yellowish or whitish head, or collar, but no indication of either remains during adult life. Reinwardt thought that these white-headed specimens constituted a distinct species to which he assigned the name *leucocephalus.* The upper lip and underparts are whitish (Flower says pale yellow) with sometimes slatish streaks. The tail is streaked or mottled beneath.

Identification.—The shields are so peculiar in this snake, that one might mention several conditions which are unique, or nearly so, by which identification is certain and easy. Perhaps the easiest way to recognise it is by noticing that the frontal touches 9 other shields. Another method is by the fact that the rostral touches 4 shields, *viz.*, the internasals, and first labials only. In all other snakes where it touches 4 shields only these are the nasals, and first labials. Again excepting two vipers, *viz.*, *Eristocophis mcmahoni* and *Pseudocerastes persicus* (both of which have only small scales on the top of the head), it is the only snake within Indian limits in which the nasal does not touch the rostral. Again it is the only snake in which the 3rd labial touches the nasal and not the eye.

Haunts.—As its English name implies it is a burrowing snake, living entirely beneath the soil. It is rarely seen above the surface except when following up its quarry or under accidental circumstances. One captured in the upstairs verandah of the General Hospital in Rangoon had probably been conveyed there in the earth of one of the pot plants.

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* P. Z. S., 1899, p. 657.

Disposition.—I have had very little experience of it in life, but it is obviously a plucky and vicious reptile from an incident recorded by Theobald* who says: "The following illustrates its ferocious nature. I once remarked a *Ptyas* (= *Zamenis*) *mucosus*, some five feet in length, in the hedge of the Circuit House of Bassein. On running downstairs, the snake had vanished, but in searching I saw its tail sticking out of a hole beneath a wooden plant-case. Do what I might I could not drag it out, as it seemed held fast within. I therefore with some trouble overturned the plant-case, and then saw that the unlucky *Ptyas* was firmly pinned by a large *Xenopeltis* into whose hole it had unwittingly entered. The *Xenopeltis* seemed about four feet in length, but on perceiving itself uncovered, released its hold of the *Ptyas*, and made its escape." Flower says: "A young snake of this species that I kept alive was fairly quiet from the first, and after one day's captivity never attempted to bite when handled. An adult specimen when excited would twist itself into an irregular pile of tight coils, except the tail, which was held on one side, raised from the ground, and the tip kept vibrating at a great speed." Colonel G. H. Evans tells me of one that flattened itself, drew back, and several times snapped at a stick advanced towards it.

Habits.—The Iridescent Earth Snake is said to be nocturnal in habit. Whether this is strictly speaking true I am not certain. Under cover of subterranean darkness it appears to be very alert during the day judging from the hasty and determined way the one, mentioned by Theobald, attacked and secured its Dhaman intruder. On one occasion in Rangoon one was sent to me in the act of devouring a snake during the day time. The one found in the General Hospital verandah in Rangoon was seen abroad in daylight.

Most of my specimens were met with in the months of July, August and September.

Food.—One in Rangoon had eaten a rat, another a mouse, and a third was eating a snake, the buff striped keel back (*Tropidonotus stolatus*). Günther† says it feeds on small mammals which it hunts for in their subterranean holes. Colonel G. H. Evans tells me the

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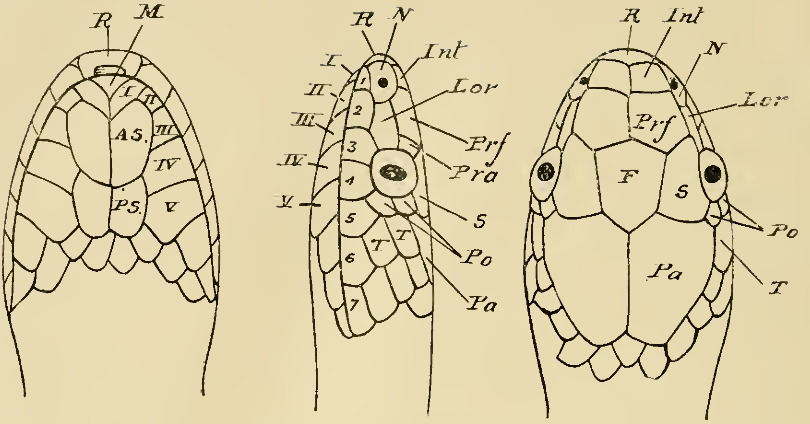
* Cat. Rept. Brit. Burma, 1868, p. 37.

† Rept. Brit. Ind., 1864, p. 181.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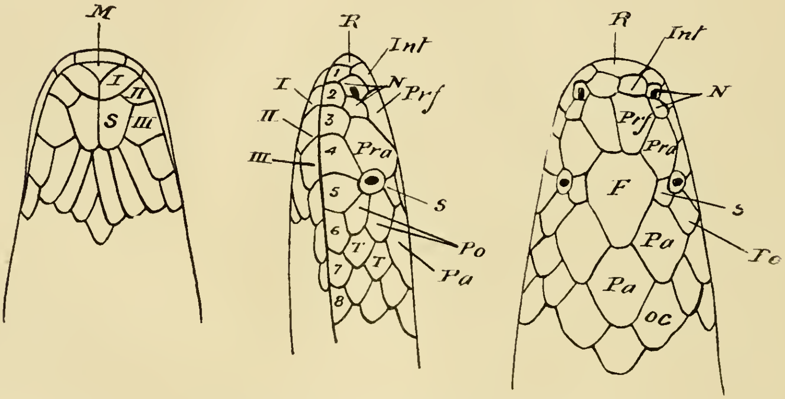
DRYOCALAMUS NYMPHA (× 2).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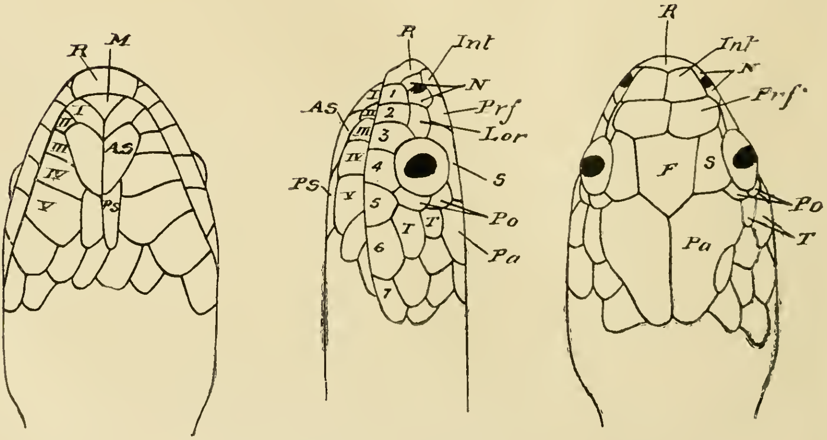
XENOPELTIS UNICOLOR (Nat. size).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DRYOCALAMUS GRACILIS (× 2½).

large specimen referred to above had eaten two fair-sized rats, and he has found a field rat taken on another occasion.

Breeding.—I know nothing of this, and can find no allusion to the subject.

Distribution. (*a*) *Geographical.*—Burma, Indo-China, Malay Peninsula and Archipelago.

It is only found in the lower part of the Burmese Province, probably not above the 20th parallel if indeed it reaches as far North as this. In Indo-China it is only recorded from the South. In the Malayan Peninsula it extends from Sumatra to Celebes.

I do not credit South India as part of its habitat, the authority for which rests on a single example from Trichinopoly now in the Indian Museum. If the specimen came from there at all, I feel confident it had been imported.

(*b*) *Local.*—It is a snake of the Plains and in Lower Burma is quite one of the common species to be met with, about Cantonments and the precincts of men as well as further afield.

Lepidosis. Rostral.—Touches four shields only, *viz.*, the internasals and first labials. *Internasals.*—Two, the suture between them about one-third that between the præfrontal fellows, one-half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them twice or more than twice the præfronto-frontal suture ; in contact with the internasal, nasal, præocular, and frontal. *Frontal.*—Touches 9 shields, the sutures with the lateral parietals longest, the præocular sutures are longer than the supraocular (another unique character). *Supraoculars.*—About one-third as long, and one-fourth as broad as the frontal. *Parietals.*—Three, a median posterior separating two lateral shields. *Occipitals.*—Two, placed behind the lateral parietals ; not in contact. *Nasals.*—Two, the nostril is quite contained in the anterior, and involves about the median two-fourths of the suture between ; not in contact with the rostral ; touches the 1st, 2nd and 3rd labials. *Loreal.*—Absent. *Præocular.*—One large, extensively in contact with the frontal. *Postoculars.*—Two, the upper larger ; almost unique in being as large or larger than the temporals. *Temporals.*—Two. *Supralabials.*—8, the 1st meets the internasal in front of the nasals, the 4th and 5th touch the eye. *Infralabials.*—3, the 3rd largest and in contact with two scales behind. *Sublinguals.*—One pair. *Costals.*—Two heads-lengths behind the head 15, midbody 15 ; two heads-lengths before anus 15; vertebrals not enlarged; last row slightly if at all enlarged; keels absent everywhere; apical pits absent. *Ventrals.*—175 to 190 (in my Burmese specimens), 180 to 196 (Flower gives for specimens from Siam), 166 to 193 (Boulenger); not very broad, being but twice the breadth of the last costal row and at least two of the last costal rows are visible on each side when the snake is laid over on its back. *Anal.*—Divided. *Subcaudals.*—The 1st or 2nd entire followed by from 24 to 31 paired shields.

Anomalies.—The postocular is single in some specimens.

Dentition.—The *præmaxilla* carries 10 small teeth, 5 on each side.

The *maxilla* supports about 38 small subequal teeth.

The *palato-pterygoid* array are largest in the middle—where they are larger and stronger than all the teeth in the other jaws—and diminish in size before and behind. The palatine number 11 to 13, the pterygoid 12, the latter set occupying about three-fourths the length of jaw that the former does.

The *mandibular* number 32 to 33, and are rather smallest anteriorly and posteriorly. This bone demands special remark from the fact that about two-thirds of the posterior part of the dentary bone (*i. e.*, that part supporting the teeth) is not articulated with the articular bone, but is loose. I believe this peculiarity, at any rate to a proximate degree, is not to be seen in any of the Indian Snakes except the genus *Polyodontophis.*

In Plate VIII of this series we figured some of the kraits which have been confused with one another in the past, and in Plates IX and X we have shown some of the harmless snakes that have been confused with the common krait *B. cœruleus.*

I think the first point that will strike many of the readers of these articles is that snakes, which appear so different with regard to their colour and markings, should be mistaken for one another at all, yet the fact remains that all of the harmless snakes we have dealt with have been wrongly considered kraits by many, and too in some cases not only by people little acquainted with ophiology, but by those in the care of Museum collections, who have specimens at hand with which to compare a doubtful snake. In several Museums I have found specimens of *Lycodons* placed with specimens of *Bungarus* and *vice versa.*

The snake which bears the most marked superficial resemblance to the krait is *Lycodon striatus*. Nearly all the specimens I have seen have been black or blackish, not brown as shown in our plate (IX, fig. 4). Its resemblance to a young krait (*B. cœruleus*) is very remarkable. The dimensions of an adult are about the same as a krait in its first year, both are black, and both have very conspicuous white cross bars. It will be remembered that I remarked upon the conspicuousness of the white bars in the young krait anteriorly, although in the adult they are usually obscure or completely absent in front. Both have the lips, and underparts completely white. In both the eye is a black jet-like bead in which the pupil cannot be discerned. In both the beautiful gloss on the scales claims special attention. Both are extremely likely to be met with inside habitations, and especially at night. On the other hand if one comes to notice scale characters it will be seen how very different the two snakes are, so different indeed that attention to one or two of the many differences can admit of no confusion between them. Thus the enlarged vertebrals of the krait are absent in the *Lycodon* and the subcaudals which are entire in the krait are divided in the *Lycodon*. Besides this the scale rows are 15 in the whole body length of the krait and have no apical pits, the anal shield is always entire, there is no loreal, there is only one temporal, there are but 4 infralabials, added to which the pupil is round. In *L. striatus* on the other hand the scales are 17 in the anterior and mid parts of the body, 15 behind, have single apical pits, the anal is usually divided, a loreal is always present, there are two temporals, 6 infralabials, and the pupil is vertical.

In the two *Dryocalami* dealt with the resemblances to the krait affect the same features detailed under *Lycodon striatus* which are those which most readily catch the eye.

By lamp light I have been deceived as to their identity taking both species at first sight for the krait. The differences in lepidosis between them and the krait are the same as those detailed under *Lycodon striatus*.

It is always a matter of surprise to me that the common variety of the Common Wolf-Snake can be mistaken for the krait. I see very little if any resemblance between the two, still nearly every specimen sent in to me is sent in as a krait. On two or three occasions, however, I have seen a resemblance between the dark variety (*oligozonatus*) and the krait so striking that I have been very much on my guard in handling it. Once grasped, and its movements controlled all doubts are set at rest at a glance. The resemblances, and differences affect the very points detailed under *Lycodon striatus*.

The Iridescent Earth-snake only resembles the krait (*B. cæruleus*) in being a glossy black. It should never be confused with this snake though for the black is uniform. There might be some justification for its confusion with the black kraits (*lividus* and *niger*), but it only occurs in a geographical area quite distinct from that of these two kraits which are only known from the Brahmaputra Basin, and the low hills in and around it. The absence of enlarged vertebrals, and the divided condition of the subcaudal shields are each sufficient to negative confusion with any krait.

(*To be continued*).

A LIST OF THE BIRDS OF THE BHAMO DISTRICT, UPPER BURMA.

BY

Major H. H. Harington (92nd Punjabis).

Part II.

(Continued from page 128 of this Volume.)

Saxicolinæ.

142. (608) Pratincola caprata, (Linn.).—(The Common Pied Bush-Chat.)

Found in the plains round Bhamo.

143. (610) Pratincola maura, (Pall.)—(The Indian Bush-Chat.)

Breeds up at Sinlum in the bracken round the Military Police Post, on the more or less open hill-top.

I was unsuccessful in finding any of their nests. When I first got up there, there were no birds about, but within a few days of the end of April, they had appeared, and when I came down, all evidently had nests, by their excited behaviour.

144. (614) Oreicola jerdoni, Blyth.—(Jerdon's Bush-Chat.)

Breeds in the long grass below the polo-ground at Bhamo during April and May, and its nest is one of the most difficult to find.

145. (615) Oreicola ferrea, (Hodgs.)—(The Dark-grey Bush-Chat.)

I found two nests with eggs in April at Sinlum. One, found about 6 p. m. on the 18th April, had four fresh eggs, the nest being placed on the top of a road-cutting about seven feet from the ground. On the 21st I was passing the same spot with a friend, and showed him where I had taken the eggs of *S. melanops* from a hole a few feet below that of the nest in question, and then putting my hand into the latter nest, I was astonished to find a cuckoo's (?) egg, the egg being a pale blue with a few spots and very much of the same colour as the eggs of *O. ferrea* taken on the 18th, but paler. The Cuckoo probably laid this egg the morning after I had robbed the nest, as no doubt it had found the nest the day before and marked it down for the following morning, when it would have its egg ready.

Ruticillinæ.

146. (632) Henicurus schistaceus, Hodgs.—(The Slatey-backed Fork-tail.)

Recorded by Col. Rippon.

I saw Forktails on two or three occasions, but as I was hoping to find their nests, did not shoot any.

147. (638) Chimarrhornis leucocephalus, (Vig.).—(The White-capped Redstart.)

148. (639) Ruticilla frontalis, (Vig.)—(The Blue-fronted Redstart.)

Both recorded by Col. Rippon.

* 149. (646) Rhyacornis fuliginosus, (Vig.)—(The Plumbeous Redstart.)

Two nests at Sinlum, both containing four eggs, one on the side of a cutting just above a stream, the other in a hole of a rock overhanging a stream; nests made of moss lined with hair and grass.

150. (647) Cyanecula suecica, (Linn.)—(The Red-spotted Blue-throat.)

Recorded by Col. Rippon.

* 151. (650) Calliope camtschatkensis, (Gmel.)—(The Common Ruby-throat.)

Three male specimens.

* 152. (653) Tarsiger chrysæus, Hodgs.—(The Golden Bush-Robin.)

One specimen.

* 153. (654) Ianthia rufilata, Hodgs.—(The Red-flanked Bush-Robin.)

One specimen.

* 154. (659) Notodela leucura, (Hodgs.)—(The White-tailed Blue Robbin).

Not uncommon near streams, the cock birds being more plentiful than the hens, having a very pretty song.

155. (663) Copsychus saularis, (Linn.)—(The Magpie—Robin.)

Common round Bhamo.

156. (664) Cittocincla macrura, (Gmel.)—(The Shama.)

Recorded by Col. Rippon.

Turdidinæ.

157. (679) Merula protomomelæna, (Cab.)—(The Black-busted Ouzel.)

Recorded by Col. Rippon.

* 158. (680) Merula obscura, (Gmel.)—(The Dark Ouzel.)

Fairly plentiful at Sinlum, and in the beginning of May were still in small parties and had no signs of beginning to breed.

* 159. (686) Geocichla citrina, (Lath.)—(The Orange-headed Ground-Thrush.)

Two specimens.

160. (693) Petrophila cyanus, (Linn.)—(The Western Blue Rock-Thrush.)

Recorded by Salvadori.

* 161 (698) Oreocincla dauma, (Lath.)—(The Small-billed Mountain-Thrush.)

One specimen.

* 162. (702) Oreocincla dixoni, (Seebh.)—(The Long-tailed Mountain-Thrush.)

Two specimens.

Ploceinæ.

163. (721) Ploceus atrigula, Hodgs.—(The Eastern Baya.) Recorded by Salvadori.

164. (723) Ploceus manyar, (Horsf.)—(The Striated Weaver-bird.) Were beginning to nest as I left Bhamo.

Viduinæ.

165. (726) Munia atricapilla, (Vieill.)—(The Chestnut-bellied Munia.) Common in the plains.

166. (735) Urloncha punctulata, (Linn.)—(The Spotted Munia.) Recorded by Salvadori.

*167. (735*a*) Urloncha topela, (Swinh.)—(The Chinese Munia.) One specimen at Sinlum, about 5,000 feet

168. (739) Sporæginthus flavidiventris, (Wallace.)—(The Burmese Red Munia.)

Recorded by Col. Rippon.

Fringillinæ.

*169. (754*a*) Propasser vinaceus, David and Oust.—(The Vinaceous Rose-Finch.)

Cat. of Birds, vol. XII, p. 416.

"*Adult male* (Type of species).—Dark crimson, the feathers being blackish with dark crimson edges; lower back and rump finer crimson or deep rosy; upper tail-coverts blackish, edged with dark crimson like the back; bastard-wing, primary-coverts and quills blackish, edged externally with reddish brown, the inner secondaries with a large spot of rosy pink at the end of the outer web; tail-feathers black; crown of head deep crimson; a distinct eye-brow of lanceolate pearly rose-tipped feathers; lores dusky blackish; sides of face, ear-coverts, and sides of body deep crimson, with faintly indicated blackish shaft-lines, more distinct on the abdomen, which is paler rose-colour; thighs black, under tail-coverts blackish, tipped with rose-colour; under wing-coverts and axillaries sooty black; quills dusky black below, a little more ashy on the inner web: 'bill brown, feet reddish grey; iris reddish chestnut.' (A. David). Total length 5·5, culmen 0·5, wing 2·8, tail 2·2, tarsus 0·8.

Hab.—Western China."

One male specimen.

170. (761) Carpodacus erythrinus, (Pall.)—(The Common Rose-Finch.)

Recorded by Col. Rippon.

171. (776) Passer domesticus, (Linn.)—(The House Sparrow.) Have seen a few in Bhamo.

172. (779) Passer montanus, (Linn.)—(The Tree Sparrow.) The Common Sparrow of the district, and found round most Kachin villages except those at about 5,000 feet.

* 173. (780) Passer cinnamomeus, (Gould.)—(The Cinnamon Tree-Sparrow.)

Over 5,000 feet. Have seen many round Sinlum, nests in holes of trees.

Emberizinæ.

* 174. (803) Melophus melanicterus, (Gm.)—(The Crested Bunting.)

Keeps to flocks well into the middle of March. I saw some in old hill cultivation round Sinlum in pairs. Probably nests in May.

Hirundinidæ.

175. (809) Cotile sinensis, (Gray.)—(The Indian Sand-Martin.)

Nests in holes along the river bank.

176. (813) Hirundo rustica, Linn.—(The Swallow.)

Recorded by Col. Rippon.

177. (814) Hirundo gutturalis, Scop.—(The Eastern Swallow.)

Recorded by Salvadori.

178. (818) Hirundo smithii, Leach.—(The Wire-tailed Swallow.)

The common Swallow of the district. I have seen no signs of it nesting there.

Motacillidæ.

179. (826) Motacilla alba, Linn.—(The White Wagtail.)
180. (827) Motacilla leucopsis, Gould.—(The White-faced Wagtail.)
181. (830) Motacilla hodgsoni, G. R. Gray.—(Hodgson's Pied Wagtail.)
182. (837) Motacilla citreola, Pall.—(The Yellow-headed Wagtail.)
183. (841) Anthus maculatus, Hodgs.—(The Indian Tree-Pipit.)
184. (845) Anthus richardi, Vieill.—(Richard's Pipit.)
185. (846) Anthus striolatus, Blyth.—(Blyth's Pipit.)

The above all recorded by Col. Rippon.

186. (847) Anthus rufulus, Vieill.—(The Indian Pipit.)

Recorded by Salvadori.

Alaudidæ.

187. (860) Alauda arvensis, Linn.—(The Sky-lark.)

I heard many larks singing in the Loijo Valley, and I presume they were of his species, but I did not shoot any specimens.

Nectariniinæ.

188. (882) Æthopyga seheriæ, (Tick.)—(The Himalayan Yellow-backed Sun-bird.)

189. (883) Æthopyga andersoni, Oates.—(Anderson's Yellow-backed Sun-bird.)

190. (884) Æthopyga cara, Hume.—(The Tenasserin Yellow-backed Sun-bird.)

Recorded by Salvadori.

191. (887) Æthopyga ignicauda, (Hodgs.)—(The Fire-tailed Yellow-backed Sun-bird.)

192. (889) Æthopyga dabryi, (Verr.)—Dabry's Yellow-backed Sun-bird.)

* 193. (890) Æthopyga saturata, (Hodgs.)—(The Black-breasted Yellow-backed Sun-bird.)

Three specimens.

194. (892) Æthopyga nepalensis, (Hodgs.)—(The Nepal Yellow-backed Sun-bird.)

195. (895) Arachnechthra asiatica, (Lath.)—(The Purple Sun-bird.)

The above all recorded by Col. Rippon, with the exception of *A. cara*.

Arachnotherinæ.

* 196. (906) Arachnothera magna, (Hodgs.)—(The Larger Streaked Spider-hunter.)

One specimen.

197. (909) Arachnothera longirostris, (Lath.)—(The Little Spider hunter.)

Recorded by Col. Rippon.

Dicæidæ.

198. (914) Dicæum chrysorrhœum, Temm.—(The Yellow-vented Flower-pecker.)

Recorded by Col. Rippon.

* 199. (915) Dicæum ignipectus, (Hodgs.)—(The Fire-breasted Flower-pecker.)

Very common in the Hills.

200. (916) Dicæum concolor, Jerd.—(The Nilghiri Flower-Pecker.)

Recorded by Col. Rippon.

Pittidæ.

201. (927) Pitta nepalensis, (Hodgs.)—(The Blue-naped Pitta.)

202. (935) Pitta cucullata, Hartl.—(The Green-breasted Pitta.)

The above two recorded by Salvadori.

Picinæ.

203. (950) Gecinus occipitalis, (Vig.)—(The Black-naped Green Woodpecker.)

204. (951) Gecinus chlorolophus, (Vieill.)—(The Small Himalayan Yellow-naped Woodpecker.)

The above two recorded by Salvadori.

* 205. (955) Chrysophlegma flavinucha, (Gould.)—(The Large Yellow-naped Woodpecker.)

One specimen.

* 206. (958) Gecinulus grantia, (McClell.)—(The Northern Pale-headed Woodpecker.)

One specimen.

* 207. (962) Dendrocopus cabanisi, (Malh.)—(The Chinese Pied Woodpecker.)

One specimen.

208. (967) Dendrocopus macii, (Vieill.)—(The Fulvous-breasted Pied Woodpecker.)

Recorded by Oates.

* 209. (974) Iyngipicus pygmæus, (Vig.)—(The Himalayan Pigmy Woodpecker.)

Three specimens. I think mine belong to this species, as they have the four central tail-feathers black, also the upper tail-coverts black.

I found a nest containing young birds on the 23rd April. I fancy they must be very early breeders.

210. (975) Iyngipicus canicapillus, (Blyth.)—(The Burmese Pigmy Woodpecker.)

Recorded by Oates.

211. (978) Pyrrhopicus pyrrhotis, (Hodgs.)—(The Red-eared Bay Woodpecker.)

Recorded by Rippon.

212. (983) Micropternus phæoceps, Blyth.—(The Northern Rufous Woodpecker.)

213. (988) Tiga javanensis, (Ljung.)—(The Common Golden-backed Three-toed Woodpecker.)

The above two recorded by Salvadori.

214. (989) Tiga shorei, (Vig.)—(The Himalayan Golden-backed Three-toed Woodpecker.)

Recorded by Col. Rippon.

215. (992) Chrysocolaptes gutticristatus, (Tick.)—(Tickell's Golden-backed Woodpecker.)

216. (998) Thriponax feddeni, (Blanf.)—(The Burmese Great Black Woodpecker.)

The above two recorded by Salvadori.

Picumninæ.

* 217. (1001) Picumnus innominatus, Burton.—(The Speckled Piculet.)

Three specimens.

* 218. (1002) Sasia ochracea, Hodgs.—(The Rufous Piculet.)

Parent bird and three eggs brought in by a Kachin on the 27th April. Nest said to have been in the hole of a bamboo.

Iynginæ.

219. (1003) Iynx torquilla, Linn.—(The Common Wryneck.)

Recorded by Col. Rippon.

Capitonidæ.

* 220. (1007) Megalæma virens, (Bodd.)—(The Great Chinese Barbet.)

Very noisy in the Hills: can be heard calling all day in the lower valleys.

221. (1009) Thereiceryx lineatus, (Vieill.)—(The Lineated Barbet.)

Common round Bhamo.

222. (1012) Cyanops asiatica, (Lath.)—(The Blue-throated Barbet.) Recorded by Col. Rippon.

° 223. (1017) Cyanops franklini, (Blyth.)—(The Golden-throated Barbet.)

Fairly plentiful in the Hills, nesting in holes of dead trees. I failed however, to get any eggs.

224. (1019) Xantholæma hæmatocephala, (Müll.)—(The Crimson-breasted Barbet.)

Very common in the Fort at Bhamo. I saw several nesting in holes before I left.

Coraciadæ.

225. (1023) Coracias affinis, McClell.—(The Burmese Roller.) Common in the plains.

Meropidæ.

226. (1026) Merops viridis, Linn.—(The Common Indian Bee-eater.) Common in the plains.

227. (1027) Merops philippinus, Linn.—(The Blue-tailed Bee-eater.) Recorded by Col. Rippon.

° 228. (1031) Nyctiornis athertoni, (Jard. and Selby.)—(The Blue-bearded Bee-eater.)

once caught two of these in our mess-room in the Fort years ago.

Alcedinidæ.

229. (1033) Ceryle varia, Strickl.—(The Indian Pied Kingfisher.) Common along the Irrawaddy.

230. (1034) Ceryle lugubris, (Temm.)—(The Himalayan Pied Kingfisher.)

I saw a pair along the river at M'ba Kha, but was unable to shoot them.

231. (1035) Alcedo ispida, Linn.—(The Common Kingfisher.) Found in the plains.

232. (1037) Alcedo meninting, Horsf.—(The Malayan Kingfisher.)

233. (1040) Ceyx tridactyla, (Pall.)—(The Indian Three-toed Kingfisher.)

234. (1043) Pelargopsis gurial, (Pearson.)—(The Brown-headed Stork-billed Kingfisher.)

The above three recorded by Salvadori.

235. (1044) Halcyon smyrnensis, (Linn.)—(The White-breasted Kingfisher.)

Common in the plains, and very noisy.

Bucerotidæ.

236. (1051) Dichoceros bicornis, (Linn.)—(The Great Hornbill.) Recorded by Oates.

*237. (1053) Anthracoceros albirostris, (Shaw & Nodd.)—(The Indo-Burmese Pied Hornbill.)

Two specimens.

I saw other Hornbills in the Hills, but was unable to procure them.

Upupidæ.

238. (1067) Upupa indica, Reich.—(The Indian Hoopoe.)

I saw some with white on their crest. Col. Rippon records *U. epops* from Yunan. It is probably migratory in the cold weather, as I have got them in the Myitkyina District.

Cypselidæ.

239. (1076) Tachornis infumatus, (Sclater.)—(The Eastern Palm-Swift.)

A few nests in the eaves of nearly every Kachin house.

Caprimulgidæ.

240. (1093) Caprimulgus macrurus, Horsf.—(Horsfield's Night-jar.)

Recorded by Salvadori.

Trogonidæ.

241. (1101) Harpactes erythrocephalus, (Gould.)—The Red-headed Trogon.)

I saw some in the lower valleys.

Cuculinæ.

*242. (1104) Cuculus canorus, Linn.—(The Cuckoo.)

Common in the Hills round Sinlum.

243. (1106) Cuculus poliocephalus, Lath.—(The Small Cuckoo.)

244. (1107) Cuculus micropterus, Gould.—(The Indian Cuckoo.)

The above two recorded by Col. Rippon.

245. (1108) Hierococcyx sparverioides, (Vig.)—(The Large Hawk-Cuckoo.)

Recorded by Salvadori.

*246. (1116) Chrysococcyx maculatus, (Gmel.)—(The Emerald Cuckoo.)

Two specimens.

247. (1117) Surniculus lugubris, (Horsf.)—(The Drongo Cuckoo.)

I watched one calling near me quite a long time. It has a monotonous whistling note.

248. (1119) Coccystes coromandus, (Linn)—(The Red-winged Crested Cuckoo.)

Recorded by Col. Rippon.

I took the following eggs while at Sinlum:—

(1) A rich glossy blue egg from a nest of *Babax yunnanensis* measuring 1·03 × ·87, very like that of the *Babax* but of a totally different shape.

(2) A pale blue egg with numerous red spots, measuring ·77 × ·54, from the nest of *Suya superciliaris,* to which eggs it has a very strong likeness, only being considerably larger.

(3) A pale blue egg with a very few pale indistinct darker blue spots, measuring ·94 × ·66, taken from the nest of *O. ferrea* referred to before.

(4) A white egg with indistinct pink smudges, measuring ·76 × ·58, from a nest of *Stachyrhis nigriceps* ?

PHŒNICOPHAINÆ.

249. (1120) EUDYNAMIS HONORATA, (Linn.)—(The Indian Koel.)

In March I procured two eggs of this Cuckoo from a Magpie's nest.

250. (1122) RHOPODYTES VIRIDIROSTRIS, (Jerd.)—(The Small Green-billed Malkoha.)

Recorded by Col. Rippon.

251. (1123) RHOPODYTES TRISTIS, (Less)—(The Large Green-billed Malkoha.)

Plentiful both in the plains and in the hills.

252. (1130) CENTROPUS SINENSIS, (Steph.)—(The Common Coucal.)

Recorded by Salvadori.

PISTTACIDÆ.

253. (1136) PALÆORNIS INDOBURMANICUS, Hume—(The Large Burmese Paroquet.)

Recorded by Salvadori.

254. (1140) PALÆORNIS ROSA, (Bodd.)—(The Eastern Blossom-headed Paroquet.)

Recorded by Col. Rippon.

255. (1145) PALÆORNIS FASCIATUS, (Müll.)—(The Red-breasted Paroquet.)

Recorded by Salvadori.

STRIGES.

BUBONINÆ —(Sub-Family.)

256. (1173) SCOPS GIU, (Scop.)—(Scops Owl.)

257. (1175) SCOPS SPILOCEPHALUS, (Blyth.)—(The Spotted Himalayan Scops Owl.)

258. (1178) SCOPS BAKKAMŒNA, (Penn.)—(The Collared Scops Owl.)

259. (1183) GLAUCIDIUM CUCULOIDES, (Vig.)—(The Large Barred Owlet.)

The above four recorded by Salvadori.

* 260. (1186) GLAUCIDIUM BRODIEI, (Burton.)—(The Collared Pigmy Owlet.)

One specimen. Fairly plentiful in the hills. Has a whistling bi-syllabic note.

261. (1187) NINOX SCUTULATA, (Raffl.)—(The Brown Hawk-Owl.)

Recorded by Col. Rippon.

ACCIPITRES.

FALCONINÆ.

* 262. (1210) ICTINAËTUS MALAYENSIS. (Reinw.)—(The Black Eagle.)

One specimen. I saw another bird near Sinlum.

263. (1217) SPILORNIS CHEELA, (Lath.)—(The Crested Serpent-Eagle.)

Recorded by Salvadori.

264. (1223) HALIAËTUS LEUCORYPHUS. (Pallas.)—(Pallas's Fishing Eagle.)

Recorded by Oates.

Fishing Eagles are very plentiful along the Irrawaddy, and as we came up the river in March we saw several nests with the young birds sitting in them, but to which species they belonged I cannot say.

265. (1228) HALIASTUR INDUS, (Bodd.)—(The Brahminy Kite.)

Common in plains and Loije Valley.

266. (1229) MILVUS GOVINDA, Sykes.—(The Common Pariah Kite.)

Kites are very common in the Plains during the dry weather, and I think are of at least two kinds.

267. (1237) CIRCUS ÆRUGINOSUS, (Linn.)—(The Marsh Harrier.)

Recorded by Oates.

268. (1244) ASTUR BADIUS, (Gmel.)—(The Shikra.)

Recorded by Salvadori.

269. (1246) LOPHOSPIZIAS TRIVIRGATUS, (Temm.)—(The Crested Gos-Hawk.)

Recorded by Col. Rippon.

270. (1248) ACCIPITER VIRGATUS, (Reinw.)—(The Besra Sparrow-Hawk.)

Recorded by Salvadori.

* 271. (1248*a*) ACCIPITER MELANOSCHISTUS, Hume.

One specimen.

272. (1249) PERNIS CRISTATUS, (Cuv.)—(The Crested Honey-Buzzard.)

273. (1267) MICROHIERAX EUTOLMUS, (Hodgs.)—(The Red-legged Falconet.)

Both recorded by Oates.

COLUMBÆ.

274. (1271) CROCOPUS PHŒNICOPTERUS, (Lath.)—(The Bengal Green Pigeon.)

275. (1278) OSMOTRERON BICINCTA. (Jerd.)—(The Orange-breasted Green Pigeon.)

276. (1281) TRERON NEPALENSIS, (Hodgs.)—(The Thick-billed Green Pigeon.)

277. (1282) SPHENOCERCUS APICICAUDA, (Hodgs.)—(The Pin-tailed Green Pigeon.)

278. (1284) CARPOPHAGA ÆNEA, (Linn.)—(The Green Imperial Pigeon.)

279. (1287) DUCULA GRISEICAPILLA, Wald.—(The Grey-headed Imperial Pigeon.)

280. (1291) CHALCOPHAPS INDICA, (Linn.)—(The Bronze-winged Dove.)

The above were all procured by us when in the Hills.

281. (1292) COLUMBA INTERMEDIA, Strickl.—(The Indian Blue Rock-Pigeon.)

Recorded by Salvadori.

283. (1304) TURTUR ORIENTALIS, (Lath.)—(The Rufous Turtle-Dove.)

Common in the Hills.

284. (1308) TURTUR TIGRINUS, (Temm.)—(The Malayan Spotted Dove.)

Common in the plains and valleys; does not ascend the hills to any height.

285. (1311) ŒNOPOPELIA TRANQUEBARICA, (Herm.)—(The Red Turtle-Dove.)

Found in the plains.

GALLINÆ.

PHASIANIDÆ.

286. (1325) PAVO MUTICUS, Linn.—(The Burmese Peafowl.)

Found in many places in the low country.

287. (1327) POLYPLECTRUM CHINQUIS, (Müll.)—(The Grey Peacock-Pheasant.)

I have not seen this bird, but the Kachins told me it was found in the low-lying valleys.

Kachin name.—Wo-graw.

288. (1328) GALLUS FERRUGINEUS, (Gm.)—(The Red Jungle-fowl.)

Plentiful in favourable localities.

289. (1332) PHASIANUS ELEGANS, Elliot.—(Stone's Pheasant.)

Major Whitehead, 93rd Burma Infantry, informs me that he shot one between the Bhamo and Myitkyina Districts, as low down as about 2,000 feet.

290. (1332*a*) CHRYSOLOPHUS AMHERSTIÆ, Leadb.—(Lady Amherst's Pheasant.)

The Kachins talk of a mythical very long-tailed pheasant which inhabits certain high hills, which they call the "*Wocree*", which I think is most probably this bird, unless it is some still undescribed species.

291. (1339) GENNÆUS HORSFIELDI, (Gray.)—(The Black-breasted Kalij Pheasant.)

Kachin name for pheasant.—Wo-rit.

Recorded by Col. Rippon.

There are two or three other species of Silver Pheasants found in Bhamo which have not yet been identified. Mr. Oates hopes in a short time to be able to write about them.

292. (1352) BAMBUSICOLA FYTCHII, Anders.—(The Western Bamboo-Partridge.)

Very plentiful above 4,000 feet. I got several nests containing four to six eggs ; one nest I found which was deserted contained six partridge eggs and two fowl's, which must have been domestic ones, as there are no Jungle-fowl in those parts. The nest was situated within 300 yards of a bungalow.

Breeds during April and May.

293. (1355*a*) Coturnix japonica, Temm.—(The Japanese Grey Quail.)

Major W. G. Nisbett of my Regiment shot a large quail while we were out, which was badly mauled by a dog beyond all hopes of making a specimen. He says he has shot many in these parts and they are all *japonica.*

294. (1356) Coturnix cormandelica, (Gmel.)—(The Rain Quail.)

Recorded by Col. Rippon.

* 295. (1364) Arboricola intermedia, Blyth.—(The Arrakan Hill Partridge.)

Kachin name.—Wo-gam.

We shot several when we were out. Some of my specimens have their throat much blacker than those in the Museum.

296. (1368) Tropicoperdix chloropus, Tickell.—(The Green-legged Hill-Partridge).

Said to be found in the Terai.

297. (1374) Francolinus chinensis, (Osbeck.)—(The Chinese Francolin.)

Plentiful in the Loije Valley.

GRALLIÆ.

Rallidæ.

298. (1389) Hypotænidia striata, (Linn.)—The Blue-breasted Banded Rail).

Fairly common.

299. (1401) Amaurornis phœnicurus, (Penn.)—(The White-breasted Water-hen.)

Common.

300. (1402) Gallinula chloropus, (Linn.)—(The Moorhen.)

Common.

301. (1404) Porphyrio poliocephalus, (Lath.)—(The Purple Moorhen.)

Recorded by Col. Rippon.

GRUES.

302. (1407) Grus communis, Bechst.—(The Common Crane.)

Cranes are very common round Numkhum during the cold weather, and I think they must belong to this species.

303. (1410) Grus sharpii, Blanf.—(The Burmese Sarus.)

Recorded by Col. Rippon.

LIMICOLÆ.

Œdicnemidæ.

304. (1419) Esacus recurvirostris, (Cuv.)—(The Great Stone-Plover.)

Found along the banks of the Irrawaddy.

PARRIDÆ.

305. (1428) Metopidius indicus, (Lath.)—(The Bronze-winged Jacana.)

Recorded by Salvadori.

Charadridæ.

306. (1432) Sarcogrammus atrinuchalis, (Jerd.)—(The Burmese Wattled Lapwing.)

Common in the plains.

307. (1434) Microsarcops cinereus, (Blyth.)—(The Grey-headed Lapwing.)

Recorded by Oates.

308. (1435) Hoplopterus ventralis, (Wagl.)—(The Indian Spur-winged Plover.)

Common along the river. On the 7th March I found one nest containing two eggs.

309. (1439) Charadrius fulvus, (Gm.)—(The Eastern Golden Plover.)

Occurs during the cold weather.

310. (1455) Numenius phæops, (Linn.)—(The Whimbrel.)

311. (1460) Totanus hypoleucus, (Linn.)—(The Common Sandpiper.)

312. (1462) Totanus ochropus, (Linn.)—(The Green Sandpiper.)

Above recorded by Salvadori.

313. (1482) Scolopax rusticula, (Linn.)—(The Woodcock.)

Major Nisbett of my Regiment shot many during our trip in the Hills.

314. (1483) Gallinago nemoricola, (Hodgs.)—(The Wood Snipe.)

A few found in the Hills.

315. (1484) Gallinago cœlestis, (Frenzel.)—(The Common Snipe.)

316. (1485) Gallinago stenura, (Kuhl.)—(The Pintailed Snipe.)

317. (1488) Rostratula capensis, (Linn.)—(The Painted Snipe.)

The above all found in suitable localities.

GAVIÆ.

Laridæ.

318. (1489) Larus ichthyaëtus, Pall.—(The Great Black-headed Gull.)

Recorded by Oates.

319. (1503) Sterna seena, Sykes.—(The Indian River-Tern.)

Found many nests on the sand-banks in the first week in March : no signs of any other birds breeding with them.

320. (1504) STERNA MELANOGASTER, Temm.—(The Black-bellied Tern.)

Common on the river; I also saw a small Ternlet, but did not secure a specimen.

321. (1517) RHYNCHOPS ALBICOLLIS, Swains.—(The Indian Skimmer.)

Common along the river.

PHALACROCORACIDÆ.

322. (1526) PHALACROCORAX CARBO, (Linn.)—(The Large Cormorant.)

323. (1528) PHALACROCORAX JAVANICUS, (Horsf.)—(The Little Cormorant.)

Both seen on the river.

324. (1529) PLOTUS MELANOGASTER, (Penn.)—(The Snake-bird.)

Common along the river.

HERODIONES.

CICONIIDÆ.

325. (1548) DISSURA EPISCOPUS, (Bodd.)—(The White-necked Stork.)

Recorded by Oates.

326. (1549) XENORHYNCHUS ASIATICUS, (Lath.)—(The Black-necked Stork.)

Seen along the river.

ARDEIDÆ.

327. (1554) ARDEA MANILLENSIS, (Sharp.)—(The Eastern Purple Heron.)

Recorded by Oates.

328. (1555) ARDEA CINEREA, Linn.—(The Common Heron.)

Recorded by Salvadori.

329. (1557) ARDEA INSIGNIS, Hodgs.—(The Great White-bellied Heron.)

Recorded by Oates.

330. (1562) BUBULCUS COROMANDUS, (Bodd.)—(The Cattle Egret.)

331. (1565) ARDEOLA GRAYI, (Sykes.)—(The Pond Heron.)

Both very common.

332. (1567) BUTORIDES JAVANICA, (Horsf.)—(The Little Green Heron.)

333. (1572) ARDETTA CINNAMOMEA, (Gm.)—(The Chestnut Bittern.)

Both recorded by Salvadori.

ANSERES.

ANSERINÆ.

334. (1579) ANSER FERUS, (Schaeff.)—(The Grey Lag-Goose.)

335. (1583) ANSER INDICUS, Lath.—(The Bar-headed Goose.)

Both found on the river.

ANATINÆ

336. (1584) SARCIDIORNIS MELANONOTUS, (Penn.)—(The Comb Duck.)

Recorded by Col. Rippon.

° 337. (1585) ASARCORNIS SCUTULATUS, (S. Müll.)—(The White-winged Wood-Duck.)

One Specimen. I have seen others shot by Officers in my Regiment.

338. (1588) CASARCA RUTILA, (Pall.)—(The Ruddy Sheldrake.)

339. (1589) DENDROCYCNA JAVANICA, (Horsf.)—(The Whistling Teal.)

340. (1591) NETTOPUS COROMANDELIANUS, (Gm.)—(The Cotton Teal.)

All found in the District in suitable localities.

341. (1592) ANAS BOSCAS, Linn.—(The Mallard.)

I believe has been shot in the District.

342. (1593*b*) ANAS HARINGTONI, Oates.—(The Burmese Grey Duck.)

We shot several in the Loije Valley. All were typical Burmese birds with no red spots on the bill.

343. (1597) NETTIUM CRECCA, (Linn.)—(The Common Teal.)

344. (1599) MARECA PENELOPE, (Linn.)—(The Wigeon.)

345. (1600) DAFILA ACUTA, (Linn.)—(The Pintail.)

346. (1601) QUERQUEDULA CIRCIA, (Linn.)—(The Garganey.)

347. (1602) SPATULA CLYPEATA, (Linn.)—(The Shoveller.)

348. (1607) NYROCA BAERI, (Radde.)—(The Eastern White-eyed Duck.)

The above all recorded by Col. Rippon.

PYGOPODES.

349. (1617) PODICIPES ALBIPENNIS, Sharpe.—(The Indian Dabchick.)

Recorded by Col. Rippon.

THE FLORA OF PANCHGANI.

BY

E. BLATTER, S. J.

(With a Map.)

The Flora of Mahableshwar has been described by H. M. Birdwood in a final edition of his "Catalogue of the Flora of Matheran and Mahableshwar" (1897). As the climate of Panchgani shows some marked differences from that of Mahableshwar, from which it is separated by a very short distance only, we thought it might be interesting to know in what direction the different climate of Panchgani has influenced the development of its flora. The physical aspect of Panchgani is too well known as to need a detailed description; a few points, however, must be mentioned if we want to draw our conclusions from a comparison of the floras of the two hill stations.

Panchgani is situated on the same range of hills which stretches in an easterly direction from the Western Ghauts at Mahableshwar, and ends about a mile from Wai. It is about 8 miles west of Wai and about 12 miles east of Mahableshwar. The elevation taken by a compensated aneroid barometer on the highest point of "Tableland" is 4,550 feet, and 4,300 feet at the Post Office, thus being about 200 feet lower than Mahableshwar. Situated to the lee of Mahableshwar it escapes the heavy rains of the outer range, which are carried away into the valleys to the north and south. The same is the case as regards the fogs; the greater part of the little that comes towards Panchgani is divided by the hills immediately to the west of the Chicklee ghat, and driven eastward in clouds along the sides of Panchgani, one portion into the valley of the Krishna, the other to the south along the valley of the Yenna. The average rainfall is 66 inches, *i. e.*, only one-fifth that of Mahableshwar. The following tables give the annual rainfall for the years 1877-91, and the monthly rainfall from September 1907 to September 1908. For these details I am indebted to the kindness of Capt. Gillespie, the Superintendent of Panchgani.

Year.	1877.	187[illegible].	1879.	1880.	1881.	1882.	1883.
Rainfall in inches	51·23	68·75	48·31	38·59	49·11	65·55	61·94

Year.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Rainfall in inches	83·96	86·17	87·94	98·50	76·51	66·25	61·90	58·53

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Minimum at 7 a.m. ..	63	70	64	58	53	58	59	71	68	67	65	65	64
Maximum at 4 p.m. ..	81	85	83	79	81	90	94	100	98	87	72	71	80

The geological formation of Panchgani is, like the rest of the Deccan, volcanic. All along the road up the hills from Wai to Dhandheghar, two miles from Panchgani, trap is found ; but the tops of the hill are capped with laterite, with a sub-soil of grey or brick-red moorum. The surface soil is for the most part a reddish clay, common to Mahableshwar, and varies in depth from six or eight inches to three or four feet ; but in many places the rock and moorum have not been reached at eight and nine feet. The laterite is a porous argillaceous rock, much impregnated with iron peroxide irregularly distributed throughout the mass. After exposure the surface of the laterite is usually covered with a brown or blackish

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ERRATA.

Owing to an error, no attention should be paid to the columns headed "Cultivated" and "Flowers in October," crosses having been placed against nearly every plant.

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about 200 feet lower than Mahableshwar. Situated to the lee of Mahableshwar it escapes the heavy rains of the outer range, which are carried away into the valleys to the north and south. The same is the case as regards the fogs; the greater part of the little that comes towards Panchgani is divided by the hills immediately to the west of the Chicklee ghat, and driven eastward in clouds along the sides of Panchgani, one portion into the valley of the Krishna, the other to the south along the valley of the Yenna. The average rainfall is 66 inches, *i. e.*, only one-fifth that of Mahableshwar. The following tables give the annual rainfall for the years 1877-91, and the monthly rainfall from September 1907 to September 1908. For these details I am indebted to the kindness of Capt. Gillespie, the Superintendent of Panchgani.

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Year 1907-08.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
Rainfall in inches..	3·41	..	0·53	..	..	0·1	0·6	1·63	..	5·04	31·23	15·68

The temperature taken since September 1907 varied from 53° at 7 a. m. in January to 100° at 4 p. m. in April. The mean temperature at noon is about 71°, and the mean daily range only 6°. For further details we add a table showing the monthly maxima and minima as observed at 7 a. m. and 4 p. m. since September 1907.

Year 1907-08.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.
Minimum at 7 a.m. ..	63	70	64	58	53	58	59	71	68	67	65	65	64
Maximum at 4 p.m. ..	81	85	83	79	81	90	94	100	98	87	72	71	80

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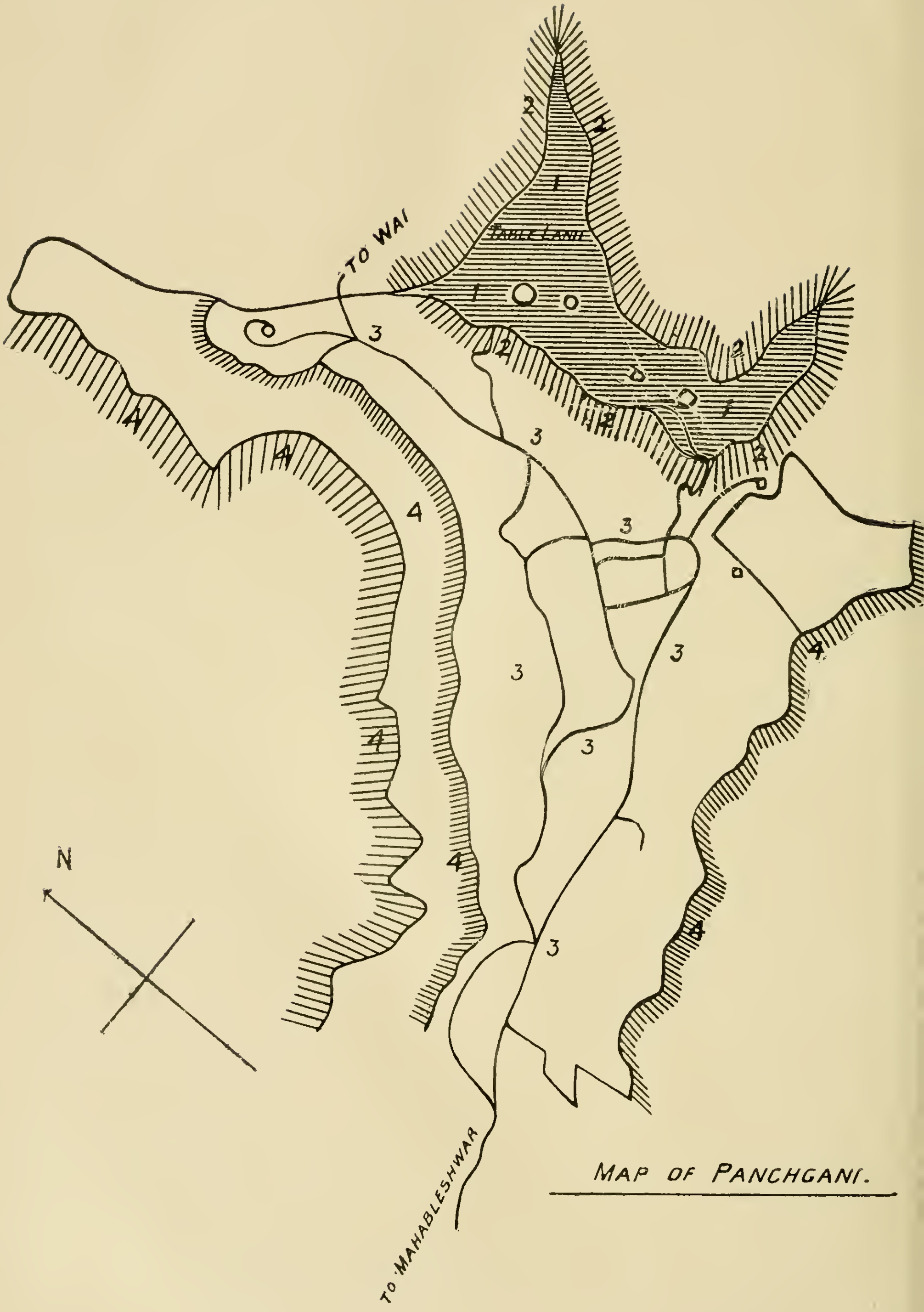
After these preliminary remarks we shall take a short survey of the flora of Panchgani. I was told that the beauties of this little hill station are best seen after the cessation of the south-west monsoon, and it was for this reason that I chose October for the botanical exploration of that place. It did not take a long time to find out that Chesson did not exaggerate when he wrote : "If there is one thing of which Panchgani may justly be proud, it is her flowers. Ever-blossoming heliotrope and myrtle are made to form hedges and disseminate their fragrance, along the drive to the house. The sweet-briar flowers with unwanted vigour and beauty. Roses in endless variety add their pleasing colours and sweetness to the scene. For untold variety and beauty of its flowers, Panchgani stands unrivalled." It is, indeed, the flowers that give a special charm and attraction to that isolated hill. It is, however, not the artistical or poetical side of the flora that we are concerned with, and in order to destroy every illusion in the reader's mind as to the character of our paper, we shall begin with a dry comparison of the flora of Panchgani with that of Mahableshwar.

Except in the east and extreme north the top of Mahableshwar is wooded to the very edge of the scarp, and though only in a few sheltered glades are there trees of any great size, the wood is so dense that it forms one vast waving stretch of rich foliage, broken by the varieties of shade from the olive leaf of the Pisa to the blue-green of the Jumbul and other fruit-bearing trees. The deep-cut roads and paths are bordered by a thick undergrowth of bracken and shaded by moss-covered trees. Panchgani, on the other hand, shares the fate of the other hills of Satara District in being very scantily wooded. It is only the village itself that is hidden in a forest of exclusively cultivated trees, mostly Casuarinas (*Casuarina equisetifolia*) with their dark green branches and Silver Oaks (*Grevillea robusta*) with their light-green foliage ; but, for the rest, we seldom meet a fine tree, and there are only a few places where nature made an attempt to form a jungle. Only in one place she succeeded, *i. e.*, on the north-western slope of the hill below the Mahratta Well. As a natural consequence, the cryptogamic flora is very poorly represented. Mosses do not grow in such abundance as at Mahableshwar, and are mostly found on the ground or on rocks. The few species of ferns form a feature of the landscape only in some places, and even there they are not developed in such a profusion and luxuriance as at Mahableshwar. Westward from Panchgani, in the direction of Mahableshwar, for about five or six miles, where the rainfall appears to be moderate, the vegetation does not show any marked changes ; but more westerly still, where the rainfall is excessive, the flora becomes altered, ferns and bulbous plants abounding. Are these differences in the development of the flora entirely due to the differences in rainfall and humidity observed on the two hills ? If so, we might ask a further question : Is the low amount of rainfall at Panchgani the result of deforestation in former centuries ? Perhaps some other time we shall be able to answer these questions.

Panchgani, small though it is, does not show a uniform vegetation in all its parts. It is not difficult to distinguish four distinct regions, each of which is characterized by its particular species.

There is first of all the Table-land (cf. No. 1 of Map A), marked off from the rest by the entire absence of any tree or shrub. I know there are a few trees along Mount Road at the entrance of the Table-land and some fine Rose-bushes and Lantanas on one side of the first tank, but it is evident that all of them, except *Lantana camara*, did not grow spontaneously. There is very little soil on the hard rock; the water flows off very readily, or collects in a few shallow tanks, and the wind has free access on all sides. The whole is covered with grass into which there are woven the loveliest of tiny flowers. Most of the characteristic plants prefer a gregarious life: there are smaller and bigger patches of a papilionaceous plant with big yellow flowers (*Smithia hirsuta*), or of the white delicate Eriocaulon, locally called "Hat-pin," or again miniature little forests of the purple *Dysophylla stellata, var. gracilis*, and whole carpets of the "Blue bonnets" (*Utricularia*). Where the grass is higher we find *Aneilema sinicum* and *Alysicarpus belgaumensis*. In rocky places with only a trace of soil the fleshy leaves of *Kalanchoe olivacea*, dotted with blood-red spots are seen. In similar localities there occurs a strange-looking little plant with dark, reddish-purple stem and branches *Striga orobanchioides*. It grows on rocks, and is very often parasitic on the roots of other plants, especially on *Asystasia violacea*. Together with the reddish-purple variety I found sometimes another one with the stem and leaves yellowish-green and the flowers white instead of pink. *Habenaria suaveolens* is still in flower in several places, though it is one of the first Orchids to appear after the breaking of the monsoon. *Justicia trinervia* is rather rare. Towards the end of October *Sopubia delphinifolia* and *trifida* make their appearance. Here we might as well make a short excursion to the "Second Table-land." The main features of the vegetation are the same, and the same herbaceous plants cover the ground. If it were not for a few stunted shrubs that grow here and there in small clusters, it would be hard to find any difference between the two plateaux. *Carissa carandas*, *Lasiosiphon eriocephalus*, *Asparagus racemosus, var. javanica* and *Pogostemon parviflorus* are prevailing. Of *Euphorbia neriifolia* I met only one specimen, and *Hiptage madablota* is leading a poor existence in a well protected crevice of the rock. Somewhat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MAP OF PANCHGANI.

different is the plateau east of Table-land. The grass attains a great height; of the small herbaceous plants that characterize the first and second Table-land scarcely any are to be seen, except on the margin of a shallow pond, and the only shrub occurring on the plateau is *Lasiosiphon eriocephalus.* When coming from Mahableshwar it is interesting to notice, how this shrub which sometimes reaches the size of a tree, is covered with a Lichen (*Usnea barbata*) to such an extent as to hide the branches entirely, and how this Lichen is getting rarer and rarer, the nearer we come to Panchgani, till in Panchgani itself and its surroundings we very seldom find a specimen of that pretty cryptogam.

To the second region (cf. No. 2 of Map A) we can assign the rather steep slope on all sides of Table-land, measuring from between 30-150 yards in breadth. A line drawn from St. Joseph's Convent in a northern direction below Table-land, leaving the cultivated fields to the left, and in an eastern direction following the path above the cemetry, will indicate the lower boundaries of our region on the north and south of Table-land. On the eastern side of Table-land it is again marked off by cultivation. The ground is mostly rocky, boulders of every size lying about; but the holes and crevices are filled up with lateritic soil. It would be easy to distinguish several sub-regions, *e.g.*, the western slope of Table-land which is better protected, richer in soil and water, and, consequently, richer in vegetation; then the eastern slope where the ground is more rocky and more exposed to the east-wind. Here the woody vegetation is scantier, and the ferns, especially the Bracken, form quite a feature of the landscape. The following description applies to the western slope only, though in the catalogue which will be given below, a plant entered with "2" in the "habitat column" may be found either on the western or eastern slope, or in some other place belonging to the belt encircling the Table-land as defined above. Of trees of some size there are very few, shrubs and undershrubs taking their place with many an interesting herbaceous plant which has never travelled up to Table-land. The Jumbul tree (*Eugenia jambolana*) is common though never so numerous as to form something similar to those beautiful endless woods of Mahableshwar. *Diospyros montana*, *Allophylus cobbe*, *Soymida febrifuga*, *Acacia intsia*, *Flacourtia latifolia* and some species of *Ficus* belong to the arbareous vegetation of this region.

Crotalaria retusa with its huge spikes of yellow flowers, the wild Sweet pea, and *Thunbergia fragrans* form a promiment feature. Here, as in many places of India, *Lantana camara* (with the local name "Blackberry") found its way into the jungle, is propagating with great rapidity, and has spread in many spots to the exclusion of all other plants. The entrance to the big cave is almost covered with the luxuriously developed Giant Sting-Nettle (*Girardinia zeylanica*), *Solanum nigrum*, and the Sting-Nettle Creeper (*Tragia involucrata*). On the wet floor of the cave itself we find the delicate *Lecanthus wightii* and the rare *Begonia crenata*.

The third region (cf. No. 3 of Map A) is situated at the height of the village. It forms a broad belt round the second region, in some places horizontal, in others slightly inclined and undulating. Towards west it is considerably prolonged. A glance at the map will show the boundaries of this region much better than an incomplete description. It is partly cultivated, partly covered with high grass. This latter part is continued on the side near the cemetry deep down into the valley, but with continually changing species of grasses and herbs. The field-crops are chiefly Nachni, Sava, Vari, Wheat, and Powta (bean); Sugar cane is also grown in places which enjoy a plentiful supply of water; English vegetables are grown where a large quantity of water is available. The place was once renowned for its Potatoes, but of late, owing to bad seed and constant use of the same soil without allowing it to remain fallow for a couple of years, the crop has very much deteriorated. Mulberries are most prolific; Peaches and Coffee grow in abundance and are of fairly good quality. I have been told by Mr. Quinn that almost all the trees, shrubs, and flowers, that have been introduced, are doing very well.

The last region (cf. No. 4 of Map A) which is richest in species, is the slope on the north-western side of the hill. It is well protected and, seemingly, better provided with water than the rest. Where the slope is not too steep and too bare of soil, there is a dense jungle with a luxurious undergrowth. To this region we must count some patches of arboreous vegetation along a few water-courses on the southern side of the hill, *i.e.*, below the cemetery and the Dalkeith Spring. In the latter place there are fine specimens of the Willow *Salix tetrasperma*). It would take too long to enumerate all the species that grow in these localities: I must, therefore, refer the reader to the catalogue.

Before concluding this paper I should like to point out the advantages of having an experimental station at Panchgani, not only for arboriculture but also for agricultural products. We are most of us aware of the wise policy of the Bombay Government during recent years in starting experimental agricultural and horticultural stations in different parts of the Presidency, and scientific agriculture on this side of India is still in advance of the rest of India; but it is not apparent why Panchgani with its particularly favourable climate has been passed over. The average rainfall is only 66 inches whilst the altitude of 4,550 feet allows the place to enjoy a temperature similar to that of Mahableshwar, without any of its disadvantages.

Everybody knows that, in general, experimental stations have almost without an exception formed a part of the scheme, wherever the work of agricultural improvement has been taken in hand. The only question is where such stations are needed. There is not sufficient reason for establishing an experimental station in a certain district simply because, in theory, it is a good thing to have a place for trying experiments. The main consideration should be whether there is anything definite to learn, any particular question to solve, and whether this has any relation to the agriculture and arboriculture of the country around. If we can answer these questions in the affirmative, an experimental station will be of practical value. When I speak of an experimental station, I am not thinking of the more specially scientific experimental inquiries, such as the finding out of new scientific truths, or the testing of scientific theories by experiments on the nutrition of plants, the assimilation of different soil constituents or of atmospheric gases by plants, the exhaustion produced by continuous cropping, or the effect of extreme application of stimulating salts,—I have in mind a more practical kind of experiment, such as the testing of the value of different processes already in use, the economical effect of various manurial ingredients upon particular crops, the collection of information regarding the outturn of crops, and especially the introduction and growth of new crops and fruit trees. Such inquiries will be for the benefit of the surrounding agriculture, supposing that the land chosen for the experimental station be composed of soil which is fairly typical of that of the country around, so that the result may be applicable to as large an area of similar land as possible. This is certainly the case with Panchgani. Its lateritic soil is practically the same as that of most of the surrounding hills. It is, besides, on the one hand, naturally not so rich as to call for no improvement, nor, on the other hand, so poor and sandy that no one would think of farming it. Improvement is certainly possible in this Presidency not only in the introduction of new varieties, but also in that of new economic species, whether these be entirely new to the country or merely new to the particular district. If we consider that various millets, maize, tobacco, tea, coffee, the potato and many other kinds of vegetables have been introduced in India, there is no reason why other species should not be imported also. As to Panchgani in particular we can confidently say that, judging from the past fifty years, tangible results may be expected, if men with scientific knowledge and skilled in agricultural work would start an experimental station. As early as 1854 Mr. Chesson settled permanently at Panchgani, and he was the first to see the importance of that place as a station for experiments. In 1862 he wrote about his results in the past and his hopes for the future: "Visitors coming here for the first time have found something to condemn in the general want of trees about the place; and when compared with Mahableshwar, this seems deserved. But this stigma will be removed in a few years, for our house-holders have been spending their money unsparingly in planting trees of every variety. The four quarters of the globe have been made to contribute in this respect. We have brought potatoes from Australia and mountain pines from the South of France; mangoes from Mazagon and coffee from the Wynaad; plums from Scotland and grapes from Boston; and we are now promised tea from Assam and Cinchona from Ootacamund. . . . Our coffee thrives luxuriantly and is improving in quality. Our fruits and vegetables are abundant, and equal to any in India. Europe vegetables grow all the year round. Mango, jack, banyan, peepul, bamboo, casuarina and such like, are springing up everywhere: and ten years hence will find this place a dense jungle. I have a good show of fruit-trees, and in great variety: apple, peach, pomegranate, grape, lemon, orange, citron, fig, guava, plantain, mango and pear are the chief, with strawberry, gooseberry and blackberry. I have been so uniformly successful with my fruit-trees, especially with those that are indigenous to the temperate regions of the globe, that I have every prospect of being able to form a fine orchard." There is no doubt that the hopes of Mr. Chesson have been realized in the meantime to a great extent and it is evident that scientific management of an experimental station might help to eliminate many mistakes and establish a sound basis on which we can proceed with improved agricultural and horticultural methods.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English names.
1. Ranunculaceæ—				
Clematis triloba, Heyne	×	4	×	Moryel.
„ gouriana, Roxb.	×	2,4	×	Moryel ; Ranjai.
„ wightiana, Wall.	×	1	×	
Magnoliaceæ—				
Michelia champaca, L.	×	3,4	×	Sonchampa; Golden champa.
3. Anonaceæ—				
Artabotrys odoratissimus, R. Br.	×	3	×	Hirva champa ; Kala champa.
Anona squamosa, L.	×	3	×	Sitaphal ; Custard apple.
4. Papaveraceæ—				
Argemone mexicana, L.	×	3	×	Pivla Dothra ; Mexican Poppy ; Gamboge Thistle.
5. Menispermaceæ—				
Cyclea burmanni, Miers	×	4	×	Pakar.
6. Cruciferæ—				
Nasturtium officinale, R. Br.	×	4	×	Water cress.
Cardamine subumbellata, H. F. & T.	×	4	×	
7. Bixaceæ—				
Flacourtia latifolia, T. Cooke	×	2, 3, 4	×	Tambat.
8. Pittosporaceæ—				
Pittosporum floribundum, W. & A.	×	4	×	Yekadi.
9. Polygalaceæ—				
Polygala persicariæfolia, D.C.	×	3	×	
10. Caryophyllaceæ—				
Saponaria vaccaria, L.	×	3	×	Sabani ; Soapwort.
11. Portulacaceæ—				
Portulaca oleracea, L.	×	3	×	Ghol-baji ; Purslane.
12. Elatinaceæ—				
Bergia capensis, L.	×	4	×	
13. Guttiferæ—				
Ochrocarpus longifolius, Benth.	×	1	×	Harkia ; Surangi ; Satwin.
14. Malvaceæ—				
Sida acuta, Burm.	×	2	×	Chikni ; Chikan kaola.
„ rhombifolia. var. retusa. Masters.	×	2	×	Bala ; Jangli-methi.
Abutilon polyandrum, W. & A.	×	4	×	Bhendi ; Rambag.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Thespesia macrophylla, Blume ...	×	4	×	Ran-bhendi ; Lahan bhendi ; Wild bhendy.
Urena sinuata, L.	×	4	×	Ran-kupat.
Kydia calycina, Roxb.	×	4	×	Warung.
15. Tiliaceæ—				
Grewia tiliæfolia, Vahl	×	4	×	Dhaman.
„ micrococcos, L.	×	4	×	
Erinocarpus nimmonii, Grah... ...	×	...	×	Cher.
Triumfetta pilosa, Roth	×	2, 4	×	Kutre-vandre.
„ rhomboidea, Jacquin ...	×	2, 4	×	Necharda.
Elæocarpus oblongus, Gærtn. ...	×	4	×	Kasan ; Kasa.
16. Linaceæ—				
Linum mysorense, Heyne	×	3	×	Bamburti ; Undri ; Yellow Flax.
Reinwardtia trigyna, Planch. ...	×	3	×	Abai.
17. Malpighiaceæ—				
Hiptage madablota, Gaertn.	×	2, 4	×	Madhvel.
18. Geraniaceæ—				
Oxalis corniculata, L....	×	1, 2, 3	×	Nalkarda.
Impatiens acaulis, Hook.	×	4	×	Berki ; Lahan Terda. The stemless Balsam.
Impatiens inconspicua, Benth. var. ramosissima.	×	4	×	Terda.
Impatiens dalzellii, H. f. & T. ...	×	2	×	Yellow Balsam.
„ balsamina, L. var. coccinea.	×	2, 3, 4	×	Terda ; Wild Balsam.
„ pulcherrima, Dalz. ...	×	...	×	
19. Rutaceæ—				
Evodia roxburghiana, Benth. ...	×	4	×	Tikatna.
Glycosmis pentaphylla, Carr. ...	×	4	×	Kirmira.
Murraya exotica, L.	×	4	×	Kunti. Pandhri.
„ koenigii, Spreng.	×	2, 4	×	Kadhi-nimb ; Kadhi-pak ; Curry plant.
Atalantia monophylla, D. C.... ...	×	...	×	Makad-limbu ; Monkey Lime.
20. Burseraceæ—				
Boswellia serrata, Roxb.	×	4	×	Salphali ; Salera ; Halera Frankincense tree.
Garuga pinnata, Roxb.	×	4	×	Kadak ; Mongheri.
21. Meliaceæ—				
Turraea villosa, Benn.	×	4	×	
Soymida febrifuga, Adr.	×	2	×	Rohan ; Polara ; Bastard Cedar ; Indian Redwood.
Cedrela toona, Roxb....	×	4	×	Tuni ; Maha-nim.
22. Olacaceæ—				
Mappia fœtida, Miers	×	4	×	Ganera.
23. Celastraceæ—				
Celastrus paniculata, Willd.	×	4	×	Kangoni.
Gymnosporia rothiana, Laws. ...	×	2, 4	×	Ankli.
24. Rhamnaceæ—				
Zizyphus rugosa, Lamk.	×	2, 4	×	Taran.
Scutia indica, Brongn.	×	4	×	Chimat ; "Wait-a-bit" thorn.
25. Ampelidaceæ—				
Vitis latifolia, Roxb.	×	4	×	Nadena.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Vitis trifolia, L.	×	1	×	Ambat-vel.
„ elongata, Wall.	×	4	×	
„ vinifera, L.	×	3	×	Angur, Grape-Vine.
„ lanceolaria, Wall.	×	2	×	Kazorlichayel.
Leea sambucina, Willd.	×	1	×	Dinda.
26. Sapindaceæ—				
Allophylus cobbe, Blumes.	×	2, 4	×	Tipan.
Nephelium longana, Camb.	×	4	×	Wumb ; Lungani.
27. Anacardiaceæ—				
Mangifera indica, L.	×	2, 3	×	Amb ; Mango tree.
28. Leguminosæ ...				
Crotalaria filipes, Benth.	×	3	×	
„ vestita, Baker	×	3	×	
„ triquetra, Dalz.	×	3	×	Ghati.
„ retusa, L.	×	2, 4	×	Dingala.
Indigofera hendecaphylla, Jacquin	×	4	×	
„ pulchella, Roxb.	×	4	×	Nerda.
Geissaspis cristata, W. & A.	×	3	×	Barki.
Zornia diphylla, Pers.	×	2, 3	×	Nal-Barga, Berki.
Smithia purpurea, Hook.	×	1	×	Burkar.
„ hirsuta, Dalz	×	1	×	
Alysicarpus vaginalis, D.C. var. nummularifolius, Baker.	×	3	×	Dhakta Dhampta.
Alysicarpus belgaumensis, Wight	×	1, 3	×	
Desmodium triquetrum, D.C.	×	3	×	Kakganga.
Erythrina indica, Lamk.	×	3	×	Pangara.
Grona dalzellii, Baker	×	3	×	
Phaseolus grandis, Dalz.	×	4	×	
„ sublobatus, Roxb.	×	4	×	
Vigna capensis, Walp.	×	2	×	Halunda, Indian Sweet Pea.
Atylosia lineata W. and A.	×	2, 3	×	Ran-Tur.
Cylista scariosa, Roxb.	×	4	×	Ran Ghevda.
Dalbergia latifolia, Roxb.	×	2	×	Sisam ; Blackwood tree.
Pongamia glabra, Vent.	×	3	×	Karanj.
Wagatea spicata, Dalz.	×	4	×	Vagati.
Cassia fistula, L.	×	4	×	Bahawa; Indian Laburnum.
„ mimosoides, L,	×	2, 4	×	
Bauhinia racemosa, Lamk.	×	2, 4	×	Apta ; Wanraj.
„ vahlii, W. & A.	×	4	×	Chambuli ; Chamyel.
Mimosa pudica, L.	×	3	×	Lajalu.
Acacia intsia, Willd.	×	2, 4	×	Chilar.
Albizzia stipulata, Boivin	×	2	×	Lullei ; Udal.
„ amara, Boivin	×	4	×	
29. Rosaceæ—				
Rubus lasiocarpus, Sm	×	2, 3, 4	×	Gauriphal ; "Raspberry."
Fragaria vesca, L.	×	...	×	Strawberry.
Prunus persica, Stokes	×	...	×	Alu ; Peach.
Pyrus malus, L.	×	...	×	Apple.
„ communis, L.	×	...	×	Pear.
Rosa multiflora, Thunb.	×	...	×	Clustering Rose.
30 Crassulaceæ—				
Bryophyllum calycinum, Salisb.	×	4	×	Panphul ; Ghoripat.
Kalanchoe spathulata, D.C.	×	4	×	
„ olivacea, Dalz.	×	1, 2, 4	×	
31 Combretaceæ—				
Terminalia chebula, Retz.	×	2, 4	×	Hirda ; Myrabolan tree.
„ tomentosa, W. & A.	×	4	×	Ain.
Calycopteris floribunda, Lamk.	×	4	×	Bagyel ; Ukashi ; Bagoli.
Anogeissus latifolia, Wall.	×	4	×	Dhanda.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Myrtaceæ—				
Eugenia jambolana, Lamk.	×	2, 3, 4	×	Jambul.
„ heyneana, Duthie ...	×	4	×	Pan-Jambul.
33. Melastomaceæ—				
Memecylon umbellatum, Burm. ...	×	4	×	Anjan; Ironwood tree.
34. Lythraceæ—				
Ammannia floribunda, C. B. Clarke...	×	4	×	
„ pentandra, Roxb. ...	×	4	×	
Woodfordia floribunda, Salisb. ...	×	4	×	Dhayati.
Lawsonia inermis, L....	×		×	Mendhi.
Lagerstrœmia indica, L.	×	5	×	Chinai-Mendhi.
„ parviflora, Roxb. ...	×	4	×	Nanch; Nanya; Lendia; Benteak tree.
35. Samydaceæ—				
Casearia graveolens, Dalz.	×	4	×	Bokhada.
36. Passifloraceæ—				
Carica papaya, L.	×	...	×	Papaya; Popai.
37. Cucurbitaceæ—				
Trichosanthes palmata, Roxb. ...	×	1	×	Kaundal.
Cucumis melo, L. var. agrestis, Naud.	×	4	×	Shinde; Takmak.
Melothria maderaspatana, Cogn. ...	×	3	×	Chirati.
„ leiosperma, Cogn. ...	×	4	×	Khuskhus.
„ heterophylla, Cogn. ...	×	3. 4	×	Gomati.
„ perpusilla, Cogn.	×	4	×	Warali.
38. Begoniaceæ—				
Begonia crenata, Dryand	×	2	×	Berki; Motyen.
39. Ficoideæ—				
Mollugo pentaphylla, L.	×	3	×	Jharasi.
„ „ var. rupestris..	×	2	×	Jharsi.
40. Umbelliferæ—				
Carum sticrocarpum. C. B Clarke ...	×	1	×	Ran-onva.
Pimpinella candolleana, W. & A. ...	×	2, 4	×	
„ monoica, Dalz	×	2, 4	×	Bhalga.
„ tomentosa, Dalz.... ...	×	2, 4	×	
Heracleum concanense, Dalz.... ...	×	2, 4	×	Pandi; Pinda.
41. Rubiaceæ—				
Mitragyna parvifolia, Korth. ...	×	4	×	Kalam; Niv.
Wendlandia notoniana, Wall. ...	×	4	×	
Oldenlandia corymbosa, L.	×	2	×	Pitpapda.
Anotis lancifolia, Hook, f.	×	2, 4	×	
Randia dumetorum, Lamk.	×	2, 4	×	Gela; Gel.
Plectronia wightii. T. Cooke ...	×	4	×	Tupa.
Vangueria spinosa, Roxb.	×	4	×	Alu; Indian Medlar.
Ixora nigricans, Br.	×	2	×	Katkuda.
Pavetta indica, L.	×	4	×	Paphti, Papti.
Hamiltonia suaveolens, Roxb. ...	×	4	×	Girsav; Gidesa.
Rubia cordifolia, L.	×	4	×	Itari.
Coffea arabica, L.	×	3	×	Coffee.
42. Compositæ—				
Centratherum tenue, C. B. Clarke ...	×	2	×	
Adenoon indicum Dalz.	×	1, 2, 3	×	Motha sunki.
Vernonia cinerea, Less.	×	3	×	Sahadevi; Motha sadori.
Vernonia indica. C. B. Clarke ...	×	2, 3	×	
Adenostemma viscosum, Forst. ...	×	4	×	Ranjireu; Jirav; Jangli Jira; Lapoti.
Ageratum conyzoides, L.	×	2, 3	×	Ganera.

	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Dichrocephala latifolia, D.C.	×	3, 4	×	Bhamburdi.
Conyza stricta, Willd.	×	1, 2, 3	×	Gondali.
Blumea malcolmii, Hook, f.	×	2, 3	×	
Siegesbeckia orientalis, L.	×	2	×	Katampu.
Bidens pilosa, L.	×	3	×	
Tridax procumbens, L.	×	3	×	
Artemisia parviflora, Buch.-Hoam.	×	2, 3, 4	×	Tel Dauni ; Bhangi.
,, vulgaris, L.	×	2, 3, 4	×	Dhor-Dauni.
Gynura angulosa. D.C.	×	4	×	Dahn; Sow-thistle.
Notonia grandiflora. D.C.	×	4	×	Vandar-roti; Cabbage-tree.
Senecio edgeworthii, Hook, f.	×	4	×	
Tricholepis glaberrima, D.C.	×	...	×	Matha Bur.
Lactuca runcinata, D. C.	×	3, 4	×	Pathari, Wild Lettuce.
43. Campanulaceæ—				
Lobelia trigona, Roxb.	×	4	×	
Cephalostigma schimperi, Hochst.	×	1, 2, 4	×	
44. Plumbaginaceæ—				
Plumbago zeylanica, L.	×	3, 4	×	Chitrak.
45. Primulaceæ—				
Anagallis arvensis, L.	×	2, 3	×	Pimpernel.
46. Myrsinaceæ—				
Mæsa indica, Wall.	×	4	×	Atki ; Atak.
Embelia ribes, Burm.	×	4	×	Vaivarang.
47. Sapotaceæ—				
Mimusops elengi, L.	×	4	×	Bakuli ; Bokul.
48. Ebenaceæ—				
Diospyros montana, Roxb.	×	4	×	Goinda ; Lohari.
49. Styraceæ—				
Symplocos beddomei, C. B. Clarke	×	4	×	Kaola, Lodhra.
50. Cleaceæ—				
Jasminum malabaricum, Wight	×	4	×	Kusar ; Wild Jasmine.
Ligustrum neilgherrense, var. obovatum, C. B. Clarke	×	4	×	Lokhandi ; Mersinga.
51. Apocynaceæ—				
Carissa carandas, L.	×	2, 4	×	Karvand, Karanda.
Holarrhena antidysenterica, Wall.	×	...	×	Kuda ; Pandhra Kuda.
52. Asclepiadaceæ—				
Calotropis gigantea, R. Br.	×	3	×	Rui.
Gymnema sylvestre, R. Br.	×	2	×	Kavali ; Pitani ; Dodi Dudhroli.
Hoya retusa, Dalz	×	4	×	Dhakti-Ambri.
53. Gentianaceæ—				
Exacum lawii, C. B. Clarke	×	3	×	Jatali ; Gaulan.
Canscora diffusa, R. Br	×	2	×	Galphugi ; Shinta.
Swertia minor. T. Cooke	×	1	×	
,, decussata, Nimmo	×	1, 2	×	Kaudi : Kadu.
Limnanthemum indicum, Thw.	×	1	×	Kumud.
,, cristatum, Griesb	×	1	×	Kumudini. Water Snowflake.
54. Boraginaceæ—				
Trichodesma indicum. R. Br.	×		×	Chota-kalpa.
Cynoglossum denticulatum var. zeylanica, C. B. Clarke	×	1, 2, 3	×	Lichardi.

———	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Paracaryum ecœlestinum, Benth. ...	×	2	×	Nichurdi "Forget-me-not."
„ malabaricum, C. B. Clarke	×	2	×	Kalanichurdi.
55. Convolvulaceæ—				
Porana malabarica, C. B. Clarke ...	×	4	×	Bhauri.
Ipomœa laciniata, C. B. Clarke ...	×	...	×	
Argyreia hookeri, C. B. Clarke ...	×	4	×	
Lettsomia elliptica, Wight	×	4	×	Bondvel.
56. Solanacee—				
Solanum nigrum, L.	×	2, 3	×	Kanumi.
„ giganteum, Jacq.	×	4	×	Kutri.
„ indicum, L.	×	2, 4	×	Chinchurdi.
Physalis peruviana, L. (run wild) ...	×	2, 3	×	Topati; Cape Gooseberry.
Datura fastuosa, L.	×	3	×	Kala-dhatura.
57. Scrophulariaceæ—				
Celsia coromandeliana, Vahl... ...	×	4	×	Kutki.
Linaria ramosissima, Wall	×	4	×	
Bonnaya veronicæfolia, Spreng. ...	×	2, 4	×	Shewal.
Striga orobanchioides, Benth. .	×	...	×	Tambdi Karicha-gavat.
Sopubia delphinifolia, G. Don. ...	×	1	×	Dhudali.
„ trifida, Buch.—Ham. ...	×	1	×	
58. Lentibulariaceæ—				
Utricularia albo—cœrulea, Dalz. ...	×	1	×	Kajatcha ghas; Sitachi asre (Sita's tears) "Blue bonnet."
„ cærulea, L.	×	1, 4	×	
„ striatula, Sm.	×	1, 4	×	
59. Acanthaceæ—				
Thunbergia fragrans, Roxb.	×	2, 4	×	Eryel.
Blepharis asperrima, Nees	×	4	×	Dikna.
Asteracantha longifolia, Nees ...	×	4	×	Kolshinda.
Hygrophila serpyllum, T. Anders. ...	×	4	×	Ran-tewan.
Strobilanthus callosus, Nees	×	4	×	Karvi.
„ heyneanus, Nees ...	×	4	×	Akra; Itari.
„ scrobiculatus, Dalz. ...	×	4	×	
„ ixiocephalus, Benth. ...	×	4	×	Karva; Darmori.
Haplanthus verticillaris, Nees ...	×	...	×	Kala Kirat; Kala Ankra.
Barleria strigosa, Willd. var. terminalis, C. B. Clarke	×	4	×	Karanti; Kali Itari.
Asystasia violacea, Dalz. ...	×	1, 2, 4	×	Akra.
Lepidagathis calycina, Hochst. ...	×	4	×	
Rungia parviflora, Nees, var. pectinata, C. B. Clarke ...	×	2, 4	×	
„ repens, Nees	×	4	×	Ghatipitpapra.
„ elegans, Dalz. and Gibs. ...	×	4	×	
Dicliptera zeylanica, Nees	×	2	×	
Justicia betonica, L. var. ramosissima, C. B. Clarke...	×	4	×	
„ micrantha, Heyne	×	4	×	
„ procumbens, L.	×	4	×	Karambal
„ trinervia, Vahl.	×	1	×	Suta; Pandhra Suta.
Adhatoda vasica, Nees	×	2, 4	×	Adulsa.
Rhinacanthus communis, Nees ...	×	...	×	Gajkarni.
60. Verbenaceæ—				
Lantana camara, L.	×	2, 3, 4	×	Ghaveri.
Callicarpa lanata, L.	×	4	×	Yesur.
Tectona grandis, L.	×	...	×	Sag; Sagwan; Teak.
Clerodendron serratum, Spreng. ...	×	2, 4	×	Bormgi; Bharang.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English name.
61. Labiatæ—				
Plectranthus stocksii, Hook. f.	×	2	×	
„ incanus, Link	×	2	×	Lal-agada.
Coleus barbatus, Benth.	×	3	×	Main-mul.
Lavandula gibsoni, Grah.	×	3, 4	×	Nivale; Indian Lavender.
Pogostemon parviflorus Benth. ...	×	2	×	Pangli.
Dysophylla stellata, Benth.	×	1	×	Marva.
Colebrookia oppositifolia, Sm. ...	×	2, 4	×	Bhaman.
Micromeria capitata, Benth.	×	3	×	Karwat.
Anisomeles heyneana, Benth... ...	×	3	×	Chandara.
Leucas montana, Spreng.	×	1, 2	×	
„ stelligera, Wall.	×	1, 2, 3,4	×	Guma; Borambi.
„ ciliata, Benth.	×	2	×	Borambi.
Nepeta ruderalis, Buch. — Ham., var. Woodrowii.	×			
Salvia plebeja, R. Br.	×	2, 3	×	Birambola, Sage.
62. Nyctaginaceæ—				
Boerhaavia diffusa, L.	×	2, 3	×	Vasu, Ghetuli.
63. Amarantaceæ—				
Celosia argentea, L.	×	3	×	Kurdu, Quail grass.
Ærua lanata, Juss....	×	3	×	Kapuri maduri.
Achyranthes aspera, L.	×	1, 2, 3	×	Sarata, Burr. plant.
Alternanthera triandra, Lam. ...	×	2, 4	×	Kanchni, Jaljamba.
64. Chenopodiaceæ—				
Chenopodium ambrosioides, L. ...	×	3	×	Sherni.
65. Polygonaceæ—				
Polygonum plebejum, R. Br. var. indica Hook. f.	×	2, 3	×	
Polygonum glabrum, Willd. ...	×	4	×	Sheral.
Polygonum chinense, L. var. ovalifolia, Meissn.	×	2, 4	×	Narali; Paral.
Polygonum alatum, Buch.—Ham.	×	2, 4	×	
66. Piperaceæ—				
Piper hookeri, Miq.	×	4	×	Ran Mirvel; Wild Pepper.
67. Lauraceæ—				
Actinodaphne hookeri, Meissn. ..	×	4	×	Pisa.
Litsea tomentosa, Heyne	×	4	×	Chikna.
„ stocksii, Hook. f.	×	4	×	Pisa.
68. Thymelæaceæ—				
Lasiosiphon eriocephalus, Decaisne.	×	2, 3, 4	×	
69. Elæagnaceæ—				
Elæagnus latifolia, L.	×	4	×	Ambulgi.
70. Loranthaceæ—				
Loranthus scurrula, L.	×	...	×	
Viscum angulatum, Heyne... ...	×	4	×	Jalundar.
71. Santalaceæ—				
Osyris arborea, Wall.	×	4	×	Lotal.
72. Euphorbiaceæ—				
Euphorbia acaulis, Roxb.	×	2	×	Kirkind.
„ neriifolia, L.	×	2	×	Thor, Nigud.
„ rothiana, Spreng. ...	×	2, 3, 4	×	Dudhi.
„ pycnostegia, Boiss. ...	×	3	×	
„ pilulifera, L.	×	3	×	

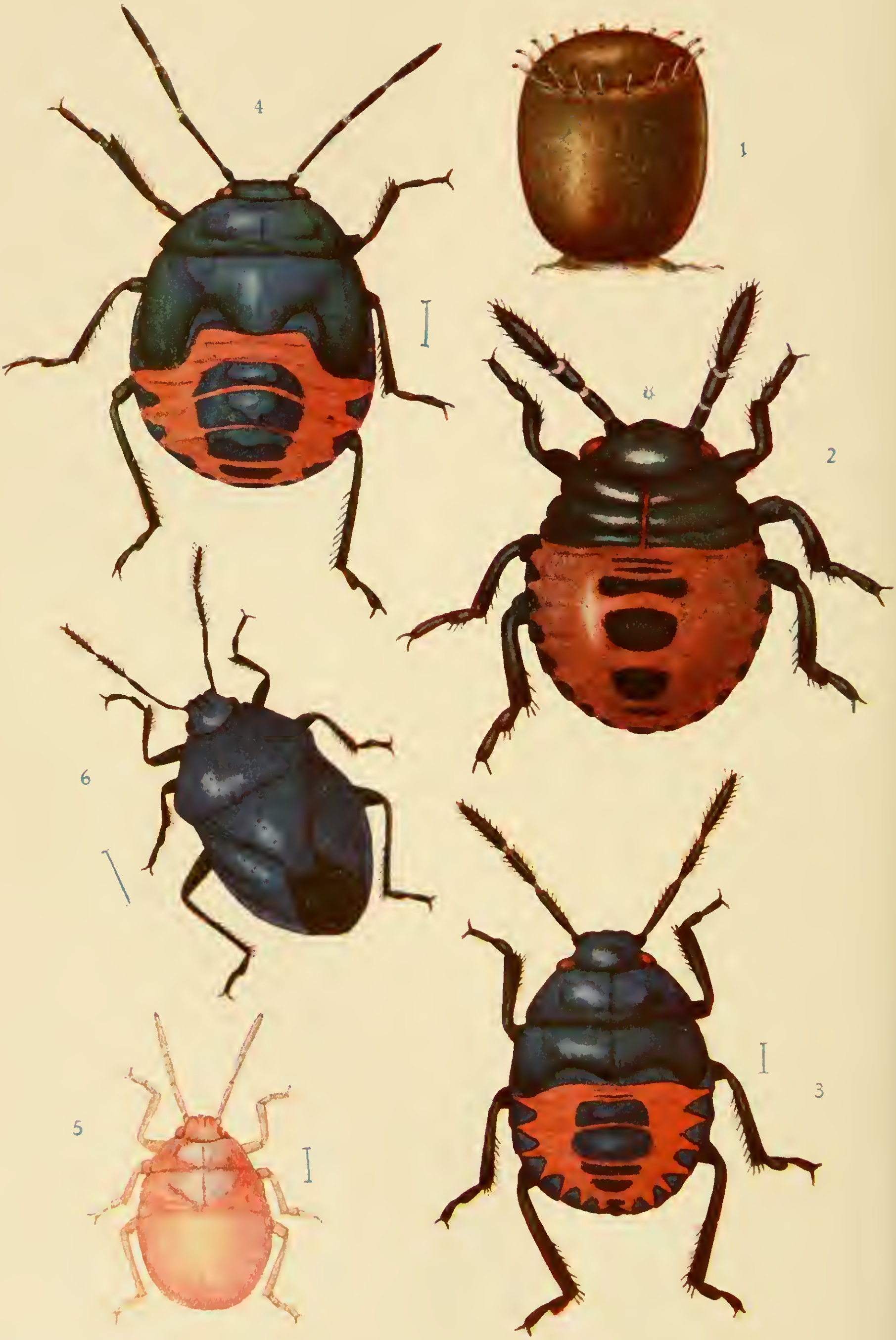
——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English name.
Euphorbia thymifolia, L.	×	3	×	Dhakti—dudhi.
Bridelia retusa, Spreng.	×	4	×	Hasana ; Asana.
Glochidion hohenackeri, Bedd.	×	4	×	Bhoma.
Fluggea leucopyrus, Willd.	×	4	×	Pandharphalli.
Phyllanthus emblica, L.	×	2, 3	×	Aula; Amla; "Gooseberry tree."
Acalypha brachystachya, Hornem.	×	...	×	
Tragia involucrata, L.	×	2, 4	×	Kolti ; Sting-Nettle creeper.
73. Urticaceæ—				
Girardinia zeylanica, Decaisne	×	...	×	Motha Khajoti : Giant Sting Nettle.
Lecanthus wightii, Wedd.	×	2	×	
Pouzolzia bennettiana, Wight.	×	2, 4	×	
Debregeasia velutina, Gaud.	×	4	×	Kapsi.
Ficus bengalensis, L.	×	3	×	Wad.
,, tomentosa, Roxb.	×	3	×	Kallu-goli.
,, retusa, L.	×	2, 3	×	Nandruk.
,, rumphii, Blume	×	2	×	Pair.
,, religiosa, L.	×	3	×	Ashta ; Pipal.
,, infectoria Roxb.	×	2, 3	×	Pipli ; Bassari.
,, glomerata. Roxb.	×	3	×	Umbar.
,, carica, L.	×	3	×	Anjir.
Artocarpus integrifolia, L.	×	3	×	Phannas : Jack-Fruit tree.
Morus alba, L.	×	3	×	Tut ; Situt ; "White Mulberry."
74. Casuarinaceæ—				
Casuarina equisethifolia, Forst.	×	3	×	Cassowary tree; Beefwood.
75. Salicaceæ—				
Salix tetrasperma, Roxb.	×	4	×	Walunj ; Willow.
76. Ceratophyllaceæ—				
Ceratophyllum demersum, L.	×	...	×	
77. Hydrocharitaceæ—				
Blyxa echinosperma, Hook, F.	×	...	×	
78. Orchidaceæ—				
Dendrobium barbatulum, Lindl.	×	4	×	Jadhia-lasan.
Porpax lichenora, T. Cooke	×	1, 2	×	
Eulophia pratensis, Lindl.	×	...	×	Satavari.
Ærides maculosum, Lindl.	×	...	×	
Habenaria rariflora, A. Rich.	×	...	×	
,, suaveolens, Dalz	×	1	×	
,, hyneana, Lindl.	×	1	×	
79. Scitaminaceæ—				
Hitchenia caulina, Baker	×	2	×	Chavar ; "Arrowroot."
Hedychium coronarium, Kœnig	×	4	×	Sontaka.
Musa superba, Roxb.	×	4	×	Ran-kel ; Chawankel ; Wild Plantain.
Zingiber macrostachyum, Dalz.	×	...	×	Sheri ; Nisam ; Wild Ginger.
80. Amaryllidaceæ—				
Curculiga orchioides, Gaertn.	×	...	×	Kajuri.
Crinum latifolium, L.	×	...	×	
81. Dioscoreaceæ—				
Dioscorea pentaphylla, L.	×	...	×	Shendvel.
,, bulbifera. L. var. sativa, Prain	×	...	×	Garkan.

———	Cultivated.	Habitat.	Flowers in October.	Vernacular or English name.
82. Liliaceæ—				
Asparagus racemosus, Willd. var. javanica, Baker ...	×	2, 4	×	Ashwal.
Smilax macrophylla. Roxb.	×	...	×	Ghotvel.
Chlorophytum orchidastrum, Lindl.	×	3	×	
83. Commelinaceæ—				
Commelina nudiflora, L.	×	2	×	Gandolgi.
Aneilema spiratum, R. Br.	×	2	×	
„ sinicum, Lindl.	×	1	×	
Cyanotis fasciculata, Schultes f. ...	×	2	×	
„ var. glabrescens, C. B. Clarke	×	2	×	
„ cristata, Schultes f. ...	×	2	×	
„ axillaris, Schultes f. ...	×	2	×	Dhakti Kaju.
84. Palmaceæ—				
Caryota urens, L.	×	...	×	Berli-mad; Fish-tail Palm; Hill Palm.
85. Aroidaceæ—				
Arisæma murrayi, Hook.	×	2, 4	×	Sapacha-kanda; "Snake-root."
Remusatia vivipara, Schott.	×	2	×	Rokhala; Wild Caladium.
86. Lemnaceæ—				
Wolffia arrhiza, Wimm.	×	...	×	
87. Eriocaulaceæ—				
Eriocaulon sp.	×	1	×	Gondali; "Hat-pin".
„ sp.	×	1	×	Gondali "Hat-pin".
88. Cyperaceæ—				
Pycreus nitens, Nees	×	...	×	
capillaris, Nees var.	×			
nilagiricus, C. B. Clarke ...	×	...	×	
Juncellus lævigatus, C. B. Clarke ...	×	...	×	
Cyperus difformis, L.	×	...	×	
„ nutans, Vahl.	×	...	×	
Fimbristylis diphylla, Vahl.... ...	×	...	×	
„ miliacea, Vahl.... ...	×	...	×	
89. Gramiaceæ—				
Paspalum scrobiculatum, L.... ...	×	3	×	Kodra.
Panicum colonum, L.	×	3	×	Borur, Sawank, Tor
„ miliaceum, L.	×	3	×	Waree, Sawa.
Tricholæna wightii, Nees	×	3	×	
Arundinella avenacea, Thw.	×	3	×	
„ tenella, D.	×	3	×	
„ brasiliensis, Raddi. ...	×	3	×	Kotir; Dundee.
„ spicata, Dalz.	×	3	×	Banel
Setaria glauca, Beauv	×	3	×	Birdi, Bandra.
„ italica R. Br.	×	3	×	Kangoni; Kora-kangoni.
Pennisetum typhoideum, Rich. ...	×	3	×	Bajri.
Oryza sativa, L.	×	3	×	Chawal; Tandul; Rice.
Coix lachryma-Jobi, L.	×	4	×	Kasai, Ranmaka.
Zea mays L.	×	3	×	Boota; Maka; Indian Corn.
Dimeria ornithopoda, Trin. ...	×	...	×	
Ischæmum pilosum, Dalz. & Gibs...	×	3	×	Kunda; Pharan.
„ laxum, R. Br.	×	3	×	Sukal.
Apluda varia Hack.	×	3	×	Tulsi; Bungrat.
Rottbœllia divergens, Hack.	×	4	×	Marvel.
Arthraxon inermis, Hook, f.	×	3	×	
„ ciliaris, Beauv.	×	...	×	
„ echinatus, Hochst. ...	×	...	×	Kadu-marvel; Marvel.
Manisuris granularis, Swart.	×	3	×	Kangri, Datura Gas.

——	Cultivated.	Habitat.	Flowers in October.	Vernacular or English Names.
Ophiurus corymbosus, Gaertn.	×	3	×	Karvel.
Andropogon contortus, R. & S.	×	3	×	Suckali Koossal.
,, schœnanthus, L.	×	3, 4	×	Rosha : Rusha ; Ginger grass.
,, muricatus, Roth.	×	...	×	Valerum, Valla.
Anthistiria cilitaa, L. f.	×	3	×	Batani.
,, cymbaria, Roxb.	×	...	×	Karar ; Ful-gavat.
Cynodon dactylon, Pers.	×	1, 3	×	Harala ; Haryeli ; Durba.
Chloris barbata. Swar.	×	3	×	Goshya ; Aptia.
Eleosine curocana, Gærtn.	×	...	×	Natchni : Nagli ; Raggi.
Triticum vulgare, L.	×	3	×	Gahun ; Wheat.
Bambusa vulgaris, Wendl.	×	3	×	Kuluk ; Bambu.
,, arundo, Klein	×	3	×	Chivari.

Filices—

Leucostegia immersa, (Wall.)
Adiantum lunulatum, (Burm.)
,, capillus veneris, (L.)
Cheilanthus farinosa, (Kaulf.)
Pteris quadriaurita, (Retz.)
,, aquilina, (L.)
Campteria biaurita, (L.)
Asplenium lunulatum (Sw.)
,, var. trapeziforme (Roxb.)
Asplenium unilaterale, (Lam.)
Lastrea odontoloma, (Moore.)
Nephrolepis cordifolia, (L.)
Drynaria quercifolia, (L.)
Pleopeltis linearis, (Thunb.)
,, membranacea, (Don.)



J. C. K. del.

ORIENTAL HEMIPTERA (No. 3).

Zicrona Coerulea.

[illegible]
THE CALCUTT

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, No. 3.

BY

J. C. W. Kershaw and G. W. Kirkaldy.

(*With Plates C and* 1.)

Papers on the metamorphoses of *Antestia anchorago*, *Dindymus sanguineus* and *Cœnocoris marginatus* have already been laid before the Society. We now offer notes on the History of *Zicrona cœrulea*, a small, metallic-looking bug belonging to the Sub-family Cimicinæ of the Family Cimicidæ.[1]

Zicrona cœrulea is distributed over the whole of the Palæarctic and Oriental Regions (except that it has apparently not yet been recorded from the Canaries, Madeira or Ceylon), and over North America. It thus ranges over 70° of latitude and 320° of longitude—for it is almost certain that its entry into America was made *via* Behring's Straits— that is to say, from the Arctic Circle to the Equator and from one shore of the Atlantic Ocean around the world to the other shore.

This remarkable insect has been reported from such varied "foodplants" as *Adimonia capreæ*, *Betula alba* and *nana*, *Calluna*, *Euphorbia*, *Glycyrrhiza*, *Juniperus*, *Mentha hirsuta*, *Rubus*, *Thesium ramosum* and Grasses! the explanation of this catholicity in taste being that it is carnivorous—like most if not all, of the Cimicinæ, though they do not always disdain vegetable nourishment—and thus, free, like most carnivora, to wander in pursuit of its prey.

As an adult the bug is, typically, steel-blue, or somewhat darker, or bluish-green—with black antennæ and smoky membrane. It varies to dark coppery (an American form) or violaceous. It measures from 6-10 mill. in length (Pl. C., f. 6).

The observations, now related, were made at Macao, off South China, the individuals investigated belonging to *Zicrona illustris*, Amyot and Serville, which is scarcely to be ranked even as a colour variety of *Z. cœrulea*, being merely larger and a little bluer. They were taken in fair numbers about the end of April (1907) on low vegetation in marshy localities, which it frequents for the sake of its food—a small beetle of the family Chrysomelidæ [2], which is exactly the same shiny dark-blue as the bug (Plate 1, fig. 1).

The eggs were laid at the beginning of May on grass-stalks and any low growing plants, in batches of about a dozen, not more, and were practically contiguous. They were shining dark-brown, smooth, with a ring of seventeen slender processes around the "lid"; the processes were whitish, the extreme apices blackish (Pl. C., f. 1.). Within the egg, just under the lid, there is a separate membranous strip with a shallow spoonlike head, strengthened by a

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[1] For family and other nomenclature, *cf.* Kirkaldy, 1908, "Catalogus Hemipterorum" I. (Dames, Berlin).

[2] Through the intervention of Dr. L. O. Howard, it was kindly identified by Mr. E. A. Schwraz as a species of *Haltica* answering to the description of *H. cœrulea*, Olivier, which inhabits India, Indo-China and Ceylon.

T-shaped chitinous rib.[3] This "head" projects slightly from the hatched-out egg (Plate I, fig. 2.) Often the "lids" drop away entirely after hatching which ensues in about five days after deposition, the nymphs moulting five times (including the final moult to adult) at intervals of about three days, except that the first nymphal instar lasts about five days. The whole nymphal period is about seventeen days, that from laying of egg to emergence of adult about twenty-three. Pl. C., fig. 2 shows the nymph of the first instar newly hatched. The antennæ are composed of four segments, the tarsi of two, while the labium reaches to about the hind coxæ. The nymphs of the second and third instars scarcely differ from that of the first, except in size and that the dark-brown parts are very nearly black, with a blue gloss. In all three instars the underside is black as regards the head and thorax, the abdomen red with the pleurites black. After each moult, the nymph, for about half an hour, is entirely pale-red or pink (Pl. C, fig. 5). In the fourth instar the tegmina are fairly distinct; in this and still more in the fifth, the antennæ are more elongate and slender, as also the legs.

In the adult bug the antennæ have gained a segment and the tarsi also one; immediately after moulting it is entirely pale shining pink; about half an hour later it is yellow-brown and an hour later (altogether one hour and a half) it has gained its metallic blue colour (Pl. C., fig. 6).

In all stages, the bugs are very active, except that as usual, from the time of hatching till after the first moult, they cluster motionless round the egg-shells and take no food[4]. They are partly gregarious, or at least occur in numbers where their prey is abundant.

The following is a summary of a bug bred during May :—

Pair in cop.	4	May 1908
♀ laid eggs	5	,,
Hatched	11	,,
First moult	14	,,
Second ,,	17	,,
Third ,,	20	,,
Fourth ,,	23	,,
Fifth ,, (to adult)	28	,,

The very young nymphs feed on the eggs of the Chrysomelid beetle (*Haltica*), the other instars on its larvæ. The adult bugs feed usually on the adult beetles, apparently on this particular beetle only, at least in the Macao

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[3] For accounts of the hatching-apparatus in Cimicidæ. *cf.* Fabre, 1903, Souvenirs Entom VIII., Chap. 5; and Heymons, 1906 Zeitschr Wissensch. Insektenbiol, II., 73-82

[4] Kirby (1894 Allen s Nat. Library, Lep. I., p. XXVI) cites Scudder regarding the fact that the Lepidopterous larva makes its first meal off its empty egg-shell to the effect that "it is designed to prevent the empty egg-shell from acting as an indication of the newly-hatched larva to insectivorous birds &c.," but value of this suggestion is lessened by the fact that the newly hatched bug nymph is equally exposed to similar danger, and is incapable of making a meal off its egg-shell.

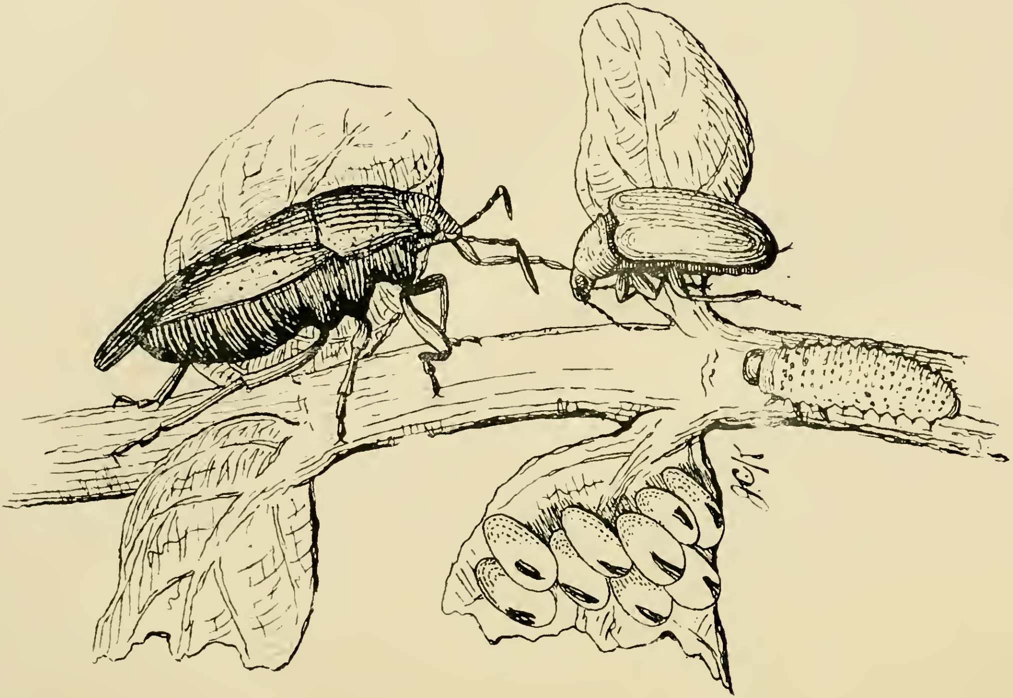


Fig. 1.

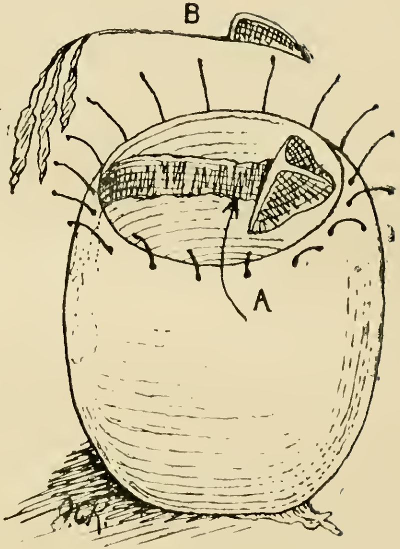


Fig. 2.

district. The beetle is exceedingly common in its proper haunts, and more or less gregarious, both adults and larvæ feeding on a small, low and dense-growing, succulent plant (*Ammannia rotundifolia*, Roxb., N.O. Lythraceæ) found in marshy ground and often in shallow water. The eggs are laid in batches on the underside of leaves of the foodplant and are long-oval smooth, yellow, with a black streak (Plate 1, fig. 1).

The young larvæ of the beetle are shining yellowish-brown, later dark brown, sparsely hairy or bristly; head and legs black (Plate 1, fig. 1). They burrow in the earth when full-grown, making cells, where they change to shiny yellow, smooth pupæ. The adult beetle, as stated previously, is of the same metallic blue as the *Zicrona* (Plate 1, fig. 1).

Whilst sucking a beetle, the bug rests head downwards on a twig, the beetle hanging free from the tip of the labium (Plate 1, fig. 1). The bug may sometimes be observed walking about with its prey so situated.

EXPLANATION OF FIGURES.

Plate C.—fig. 1. Egg of *Zicrona cærulea.*
,, 2. Nymph about one hour after hatching.
,, 3. Nymph of fourth instar.
,, 4. Nymph of fifth instar.
,, 5. Nymph of third or fourth instar, just moulted.
,, 6. Adult.

Plate 1, fig. 1. *Zicrona* feeding on beetle (*Haltica cærulea* (?)—usual position—eggs, larva and food-plant (*Ammannia rotundifolia*) of beetle.
2. Egg of *Zicrona cærulea* : lid removed, showing the lifting spring.
A. the white T-shaped rib on the " head " of the strip is strongly chitinized, the rest is membranous.
B. side-view of A.

All these figures are magnified.

[Note on " Biological Notes on Oriental Hemiptera" No. 3.

On page 333 above, the life history of *Zicrona cærulea* is described by Messrs. Kershaw and Kirkaldy. In the first paragraph, the authors state that this belongs to the " Subfamliy *Cimicinæ* of the Family *Cimicidæ*." This bug is in the Fauna of India placed in the Family *Pentatomidæ*, Subfamily *Asopinæ,* and the term *Asopinæ* has been recently replaced by the term *Amyoteinæ.* The family *Cimicidæ* is, in the " Fauna of India," that which includes *Cimex*, the bed-bugs. The authors above have used *Cimicidæ* to mean *Pentatomidæ*, believing the term to be more accurate on grounds of priority ; but their use of the term will certainly mislead students of entomology, to whom Mr . Kirkaldy's discoveries in nomenclature, as expounded in his " Catalogus Hemipterorum 1908 " are not known. Those to whom the " Fauna of India," Rhynchota, Vol. I, by W. L. Distant, is familiar, will find this bug on page 255. Practically all entomologists used the term *Pentatomidæ* for this family and the author's use of *Cimicidæ* may be for this reason somewhat confusing to our Indian readers.

The description given of the life history of the Chrysomelid beetle *Haltica cœrulea* agrees with that of its ally *Haltica cyanea* in India, the food-plant being also the same: as the bug also occurs in India, it will be interesting to know whether its habits are the same and as *Haltica cyanea* breeds freely on *Ammannia* in October, some observer may be able to find *Zicrona* predaceous on it in India also. EDS.]

NOTES ON SNAKES FROM THE NEIGHBOURHOOD OF DARJEELING.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

(WITH A PLATE.)

Between the 24th June and the end of November 1908, I had opportunities of examining 984 snakes representing 48 different species from the locality of Darjeeling. Of this large total 778 were collected by myself with the very material assistance of friends, 95 were in the Darjeeling Museum, and 111 in St. Joseph's College collection. My thanks are due to several gentlemen who spared no pains in helping me. Among these I would mention Mr. J. L. Lister of Pashok Tea Estate, Mr. A. W. Wright of Tindharia, Mr. H. K. Robinson, the Forest Officer at Kurseong, and Mr. de Abreu of Victoria School, Kurseong. My acknowledgments are also due to Mr. Fritz Moller for allowing me to examine the collection in the Darjeeling Museum, and to the authorities at St. Joseph's College for giving me access to their collection.

The area over which Mr. Lister's coolies collected is an extensive one ranging between altitudes varying from 1.200 to 5.200 feet near Darjeeling and the mention of Pashok hereafter implies this area. No less than 408 specimens were collected here. Mr. Wright's coolies collected about the Railway between the foot hills and Tindharia, *i e.*, at an altitude between about 500 and 2,800 feet. Tindharia in the following pages implies this area. From here I received 75 specimens. Mr. Robinson and Mr. de Abreu collected at Kurseong between elevations of 5,500 and 6,500 feet, and got me 242 specimens. The Darjeeling Museum specimens have no localities attached, but Mr. Fritz Moller told me that nearly all had been collected by a neighbouring Planter from slopes ranging between about 2,000 and 4,500 feet. The St. Joseph's College collection has been for the most part accumulated locally. Amongst other interesting specimens there are several which had been collected by the late Dr. Vincent Richards, one of our greatest ophiologists in the special department concerning toxicology. These specimens, nearly all venomous, I could distinguish because they had been preserved in spirit, whereas the rest of the specimens are in formalin. Dr. Vincent Richards' specimens are not local ones, but were certainly collected in the Bengal Plains where he spent all his service.

The specimens collected by me locally in and about Darjeeling are from altitudes well between 6,000 and 7,500 feet.

From Pashok I obtained 31 species, and from Tindharia 25. From Kurseong only 6 out of 242 specimens. From Darjeeling I got only 9. In the Darjeeling Museum there are 30 species and in St. Joseph's College 37, at least 9 of which are certainly not local, viz., *Eryx conicus*, *Simotes arnensis*, *Dipsadomorphus gokool, and D. forsteni*, *Bungarus cœruleus*, *B. fasciatus*, *and B. walli*, *Echis carinatus*, *and Vipera russelli.*

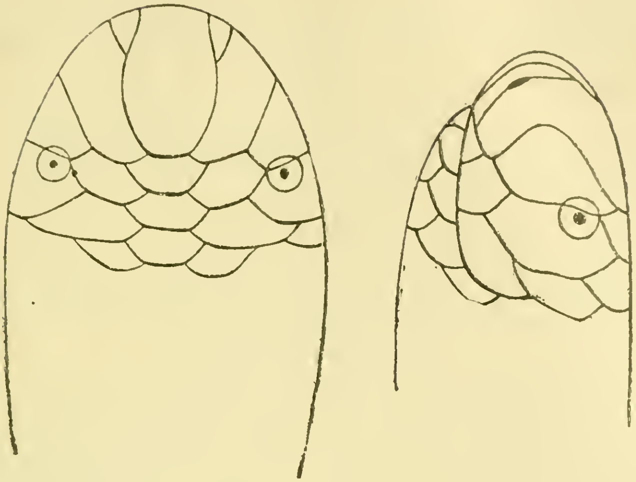
Of the 48 species with which this paper deals 42 were obtained by or for me, the remaining 6, viz., (1) *Typhlops oligolepis*, (2) *Zaocys nigromarginatus*, (3) *Ablabes stoliczkæ*, (4) *Dryophis fronticinctus*, (5) *Bungarus bungaroides*, and (6) *Naia bungarus*, were seen in one or other of the two museums referred to above. Of the 48 species, two, not including the snake *Bungarus niger*—which remains to be described in a future paper on the snakes of Assam—are new, viz., *Typhlops oligolepis* and *Oligodon melaneus*. In 6 instances the previous records of habitat have been extended, viz., *Lycodon jara*, *Ablabes stoliczkæ*, *Dryophis fronticinctus*, *Dipsadomorphus cynodon*, *Bungarus lividus*, and *Bungarus niger*.

I have also tried to show justification for doubting the Eastern Himalayas as within the range of distribution of one species, viz., *Trachischium monticola* (see footnote, p. 343).

TYPHLOPIDÆ.

Typhlops jerdoni.—Boulenger.

I obtained one specimen of this rare snake hitherto only known from two examples, the type from the Khasi Hills, and a specimen in the Indian Museum from Buxa Dooars. My specimen came from Pashok or below Tindharia, I cannot be sure which, as some specimens got mixed. In either case it must have been below 5,200 feet. It measured 9¼ inches. The body is depressed and its transverse diameter one thirty-fourth the total length. It agrees with Boulenger's description except in the breadth of the rostral which is at its broadest part above about one-third the broadest part of the head. (Blgr. hardly one-fourth). It is brownish-black above, dun beneath.



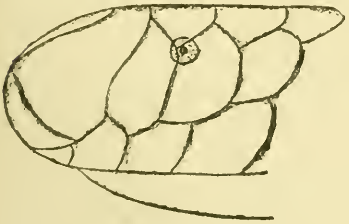
Typhlops jerdoni (× 7).

Typhlops oligolepis, spec. nov.

In the Darjeeling Museum I found a very small *Typhlops*, only 5½ inches long, with the lepidosis so different from any other species yet recorded that I have no hesitation in considering it new to science. To begin with the scales are in 16 rows, fewer by two than in any other recorded species. It is almost certainly the specimen Dr. Seal spoke to me about which he had presented to the Museum, and which he found dead on a road in the Nagri Valley below Darjeeling at an altitude of about 5,000 feet. Several people who saw it discredited the idea of its being a snake at all, and as there is only one *Typhlops*, *viz.*, this one in the Darjeeling Museum there can be little doubt that it is Dr. Seal's specimen.

Description.—Snout rounded. Nostrils lateral. Eye very small. Tail with no terminal spine. Cigar—brown above, paler beneath.

Lepidosis. Rostral—Broad, more than one-third as broad above as the greatest breadth of the head, not extending back to the level of the eyes, but about as far as the posterior edge of the nasal shields. *Internasal*, *frontal*, *supraoculars parietals* and *postoculars* subequal. *Nasals* very large, completely divided, the upper suture passing to the rostral, the lower to the 2nd labial ; largely in contact behind the rostral ; the anterior shield not or barely seen above. *Præocular* subequal to ocular ; in contact with the 2nd and 3rd labials. *Ocular* in contact with the 3rd and 4th labials. *Postocular*



Typhlops oligolepis.
(*Much enlarged*).

a single shield. The detail of the scales partly owing to the diminutive size of the snake is most difficult to see. I believe, however, the detail in the figure attached is accurate.

BOIDÆ.

Python molurus.—(Linn).

One small specimen was captured at Tindharia. A small stuffed example, and the skin of a fairly large specimen are in the Darjeeling Museum.

COLUBRIDÆ.

Polyodontophis collaris (Gray).

I obtained 58 specimens of this common hill snake. 5 of these were from Kurseong, 2 from Darjeeling, 46 from Pashok, 1 from Tindharia and 4 are doubtfully from one or other of the last two localities. The single example from Tindharia shows it is rare below 3,000 feet.

One shield character demands special remark, *viz*., the temporal. In every specimen I have seen of this snake from China (Hongkong) westwards, and I have seen well over one hundred, the temporal touches the 8th only of the supralabial series, which is an unusually high shield. I mention this because Boulenger says the anterior temporals are one or two, and he figures, Catalogue Vol. 1, 1893 (Plate xii, fig. 1*c*), a lower temporal touching two of the supralabial series. I am strongly inclined to the view that this arrangement denotes a species apart. The constancy of these shields in this Genus is remarkable, so much so that I believe they can be relied upon to carry considerable weight in differentiating the species, some of which are very closely allied and in consequence have been confused. The largest specimen was a ♀ 2 feet 6¾ inches long, the smallest probably a hatchling was killed in July and measured 8½ inches. In one the 3rd subcaudal shield was entire. One was killed in the act of swallowing a skink (*Lygosoma indica*).

Tropidonotus parallelus (Blgr).

I only saw two specimens of this seemingly rare snake, one was collected at Pashok in September. The other was in the collection of St. Joseph's College, probably of local origin, but locality not recorded. The species is remarkably like *platyceps* in general appearance. The anterior temporals are two in one specimen. The ventral and subcaudals are 163 + 92, and 167 + 88, the 3rd and 4th subcaudals entire in one specimen.

Tropidonotus piscator (Schneider).

The solitary specimen received was one of variety *quincunciatus*, and obtained below Tindharia. It is evident this snake rarely leaves the plains and then only ascends to the low foot hills.

Tropidonotus platyceps (Blyth).

This is an extremely common snake in this part of the Himalayas between 5,000 and 6,000 feet. Of a collection of 242 specimens made in Kurseong 57 were of this species, but below 4,500 feet it was far less common. I got 11 from Pashok, 2 from Tindharia, and one from Phoobsering (circa 4,500 ft.). Above 6,500 feet I got but 1, *viz.*, from Darjeeling. The most remarkable feature in the colouration of this snake is the brilliant crimson band on each side of the ventrals in adults. Nearly all the specimens were so ornamented. Very young specimens had no trace of this flaming hue. One young specimen which had swallowed a skink (*Lygosoma indica*) was rent in the side so that the back legs of the lizard protruded

Tropidonotus himalayanus (Günther).

This species has an extensive range of altitude. In Assam it is not uncommon in the Plains, and here in the Eastern Himalayas the 6 specimens collected were from below Tindharia up to Darjeeling. Two examples had eaten large specimens of the common eastern toad (*Bufo melanostictus*). The labials in two were aberrant numbering 7, the 3rd and 4th touching the eye.

Tropidonotus stolatus (Linn).

My only specimen was from below Tindharia.

Tropidonotus subminiatus (Schlegel).

Of 37 specimens collected, 34 were from Pashok, and 3 from Tindharia. The labials though usually 8 with 3rd, 4th and 5th touching the eye, are very frequently 9 with the 4th, 5th and 6th touching the eye. There were 4 postoculars on one side in one specimen, and the anal was entire in another. The subcaudals were 96 in one example. The young have bluish heads, a hue which enhances the ornamentation of this very brilliantly coloured snake. My smallest specimen was 10 inches, and was killed between the 25th of July and 5th of August.

Pseudoxenodon macrops (Blyth).

57 specimens of this very common Eastern Himalayan snake were acquired, 2 from Darjeeling, 17 from Kurseong, 35 from Pashok, and 3 from Tindharia. One brought to me by Dr. Seal had been encountered in his garden, and when disturbed struck fiercely at him with erect, and flattened neck. The degree to which this snake flattens its neck is very marked being more pronounced, I think, than in any of the *Tropidonoti* with which I am acquainted. One example was found to have eaten a frog. The largest was a ♂, 4 feet 2½ inches, and in this the secretion of the anal gland was ochraceous-yellow and of the consistency of custard. A pahari told me it is called by them "Gooroobi Samp," and he referred to the way it flattened its neck.

The ornamentation of this species is very varied, and in some specimens extremely beautiful. In a young example the head was slaty-blue, behind this the nape bore a broad intensely black arrowhead, bordered behind with a narrower band of cinnamon. In some specimens the head is rich dark-green, in some the arrowhead is billiard-cloth green, in others lilac, and in others is completely absent. In some the back is nearly uniformly olivaceous-green or brown. In some the series of dark costal spots is but obscure, in others very black, or purplish. In some no trace of light crossbars can be seen, in others they are more or less distinctly visible, in others very conspicuous sometimes whitish, sometimes cinnamon, or the anterior whitish, and the posterior cinnamon. Some specimens are chequered with green, black, amber and ochre spots. With all this variety of form the specimens do not lend themselves to a grouping into colour varieties, for scarcely two specimens are quite alike. The costal scales are, as far as I am aware, quite unique in this species. The median 5 or so rows are straight, the remaining rows slightly oblique, except the two last which again are straight. As in the *Tropidonoti* the scales are in 19 rows till just beyond the middle of the body when they become 17 by an absorption of the 3rd row above the ventrals. Sometimes this absorption takes place at or before midbody.

Trachischium fuscum (Blyth).

In the vicinity of Darjeeling this is by far the commonest species to be met with between about 5,000 and 7,500 feet. I obtained 194 specimens, 151 from Kurseong, 33 from Darjeeling, and 10 from Pashok. These varied in length from 5¼ inches to 1 foot 4¾ inches.

Sexes.—Of 88 specimens sexed 51 were ♀♀, 37 ♂♂. The largest ♂ was 1 foot 2¼ inches, but several ♀ exceeded this measurement, the largest being 1 foot 4¾ inches.

Breeding.—The pairing season was evidently over, for many hatchlings between 5 and 6 inches in length were obtained in July. Seven out of 31 ♀♀ collected in that month in Kurseong were gravid, the smallest being 1 foot and ¾ of an inch. One contained 6 eggs, two 4 eggs and four 3 eggs, the largest egg measuring from ¾ to 1 inch in length, and about ¼ inch in breadth. The young are apparently between 5 and 6 inches long as they emerge from the egg.

The secretion of the anal gland was found to be custard-like.

Food.—This snake appears to feed exclusively on earth worms, several were killed in the act of swallowing a worm, almost every specimen I opened had fragments of worms or entire worms in the stomach, and the intestines much distended with mud, evidently from the alimentary system of worms. From the many specimens I opened I should judge the snake to be voraciously vermivorous.

Lepidosis.—Boulenger says that the præfrontal is usually single. I found it invariably single. 165 was the largest number of ventrals and 31 the smallest number of subcaudals. In one specimen the first 9 subcaudals were entire, in another the last ventral was divided. The ♂ have the scales in the region of the vent rather more obviously keeled than the ♀. The eye is very black, but if closely viewed the iris is seen to be dark-brown (almost liver coloured), and the pupil is discernible.

It is a very gentle little snake, often encountered in daylight about the roads in Darjeeling. I frequently handled it without its attempting to bite me. At Kurseong it is so abundant that it can be found under most stones on the slopes about there, and Mr. H. K. Robinson told me that after rewards for snakes had been offered, the hill men would alter the landscape features of a whole hill side by rolling over each stone in their search for snakes which when brought in consisted almost entirely of this species.

Colour.—Adults are black, or blackish with iridescent effects on reflected light in life. When looked at closely the scales are seen to be studded with black dots and often these are congregated more heavily at the sides of the scales so as to produce an obscurely striated pattern. The belly is glossy uniform black. The young are very obviously streaked with black on a brownish or greyish ground, the two lines on the confines of the 1st and 2nd, and 3rd and 4th rows above the ventrals being usually most pronounced. Young specimens too have an opaque yellowish collar which is incomplete vertebrally.

Trachischium guentheri (Boulenger).

I obtained 37 specimens, 7 of these were from Darjeeling, the rest from Pashok. It is fairly common at altitudes between about 3,000 and 7,000 feet, being more abundant than *fuscum* at the lower limits of this range, far less so than *fuscum* at the higher elevations.

Sexes.—Of 18 sexed, 14 were ♀ ♀ and 4 ♂ ♂. The largest specimen was a ♀ 1 foot 5¼ inches.

Breeding.—Only one gravid ♀ was included in the above total. This was killed in Darjeeling on the 11th of July and contained 6 eggs measuring about ¾ of an inch in length.

Habits.—Like *fuscum*, I found it a very gentle snake, and it was nearly always encountered in day-light. I found one crossing a jungle road in Lebong at dusk one evening, and having dismounted secured it with little difficulty. One young one I caught one morning on the floor of the rink.

Lepidosis.—The ventrals ranged up to 154 in number, and the subcaudals as low as 30. In one specimen the 6th subcaudal was entire, and in another the first 8 were entire.

Colour.—Adults are streaked brown and black usually. In some there is a coral-reddish tinge in the brown, especially noticeable posteriorly. The scales in life exhibit an iridescence as the light glances upon them. The belly is usually uniform bright coral-red, but in some specimens a variable extent of the anterior length is black (rarely greyish-black) which becomes mottled with coral-red more and more till this hue becomes uniform. In one or two specimens almost the entire length of the belly was black, a very limited extent posteriorly showing any red, and the specimens were in consequence extremely like *fuscum*. Young examples have a more or less obscure yellowish collar.

Trachischium tenuiceps. (Blyth).

Of the 17 examples collected, 15 were from Pashok, and 2 from Tindharia. It is obviously the least common of the three Himalayan species.* One specimen—that from Tindharia—obtained in July was gravid. It measured 1 foot 4 inches and contained 5 eggs. In many specimens the loreal failed to touch the internasal. This is remarkable for the contact of these shields is a generic character and I have known no exception in all the other species I am familiar with. The adult is blackish but if examined closely, a yellow ground colour is to be observed dorsally which is more or less heavily speckled with black, especially at the lateral margins of the scales forming an obscure black striation. The belly in all my specimens was brilliant uniform yellow or orange.

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* I say the "three" Himalayan species because I cannot help thinking that *monticola* though recorded from this Range does not really occur there. The only specimens known are the 9 collected by Jerdon now in the British Museum, and said to have come from Darjeeling, but I strongly suspect are from the Khasi Hills. It would appear from this record that the snake is, to say the least, not uncommon about Darjeeling. I venture to think that no part of India has been so well worked over as the vicinity of Darjeeling and it is significant that there is no specimen in either of the two fairly large local collections there, and that I failed to obtain a single specimen among the large number which passed through my hands. Further Jerdon collected extensively in the Khasi Hills, where last year I found *monticola* a common snake, and it is surprising that no specimen appears to

The length varied between 6¼ inches to 1 foot 4 inches. The ventrals ranged from 120 to 140 ; and the subcaudals from 28 to 39. It appears to be rare at the altitude of Darjeeling if it occurs there at all, and it is evidently uncommon below Tindharia, but not uncommon at altitudes between about 2,500 and 5,000 feet.

Lycodon jara (Shaw).

A solitary specimen was sent me from Pashok, an adult ♀, and I examined another in the Darjeeling Museum. The labials were 8 as I usually find them, (Boulenger says 9 or 10) and the 3rd, 4th and 5th touched the eye. The anterior temporal was single. The ventrals and subcaudals 188+66. It does not appear to have been recorded before from the eastern Himalayas [*].

Lycodon aulicus. (Linn).

All the 19 specimens collected were from comparatively low elevations, *viz.*, 8 from Tindharia where Mr. Wright tells me it is one of their commonest snakes, and 11 from Pashok. They all conform to variety D of Boulenger's Catalogue, except that the labials are variously mottled or spotted. One ♀ captured between the 10th and 20th July contained 5 nearly mature eggs. One specimen had swallowed a skink probably *Lygosoma indica*, and another a mouse and a skink. In one the labials were 10, the 4th and 5th only touching the eye, in another the first 3 subcaudals were entire.

Dinodon septentrionalis (Gunther).

A single young specimen from Phoobsering (circa 4,500 ft.). Length 9¾, tail 2⅛ ins. Ventrals 207, anal entire, subcaudals 92. Costals, two heads-lengths behind head 17, midbody 17, two heads-lengths before vent 15. In the step from 17 to 15 the 3rd and 4th rows above the ventrals blend. The frontal is extensively in contact with the præcoculars. Contained a lizard of the Genus *Lygosoma*.

Zaocys nigromarginatus (Blyth).

I examined a single specimen which is in the Darjeeling Museum.

Lepidosis.—The costals are in 19 rows in the fore neck, but become 18 by the 7th scale in the vertebral row behind the parietals being absorbed into the next

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have been obtained by him there if one refers to the Catalogue of the British Museum (Boulenger, 1893-96). Added to these considerations, there is the fact that in at least one other instance, vide *Dinodon septentrionalis* (Boulenger, Cat., Vol., 1, p, 363), a specimen of Jerdon's collecting has been recorded dubiously from the Khasi Hills or Himalayas.

[*] I have examined another young specimen from Tindharia sent to me by the Bombay Natural History Society about four years ago.

row on the left side. This reminds one of the costal absorption in *Zamenis mucosus* when the rows reduce from 17 to 16, which is invariably produced by the vertebral row becoming confluent with the next row on the left side. At a point 2 heads-lengths after the head the rows are 16, at midbody 16, and 2 heads-lengths before the vent 14. I cannot agree with the designation of the shield, called by Mr. Boulenger a subocular. It appears to me obvious that this has originated from a division of the 3rd supralabial, and I am of opinion that this labial should be recorded as divided and included as one of the labials touching the eye. The ventrals and subcaudals are 193 + 124.

Zamenis korros (Schlegel).

Two specimens were collected at Pashok.

Zamenis mucosus (Linn).

A single specimen from Tindharia.

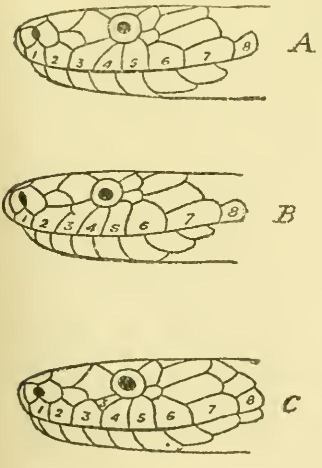
Coluber porphyraceus (Cantor).

Of 8 specimens collected, 2 were from Tindharia, and 6 from Pashok. Probably it is more common than these figures would suggest as I saw 6 specimens in the St Joseph's College collection, and 11 in the Darjeeling Museum. The young are buff coloured with uniformly black, white-edged broad cross-bars, which make them appear very different from the adults.

Coluber cantoris (Boulenger).

This is one of the commonest species to be found about Darjeeling, but does not occur or is rare below about 5,000 feet elevation. I got 10 specimens, 1 from Darjeeling, 4 from Pashok and 5 from Kurseong. There were 7 in the Darjeeling Museum and 4 in St. Joseph's College collection.

Lepidosis.—The costals are unusual in this species, in that the rows are two less in front than in midbody, a condition I have seen in some others of the genus, viz., *hodgsoni*, *helena*, etc. Other species of the same Genus as now understood have the same number of scale rows in front as in the middle of the body, viz., *porphyraceus*, *oxycephalus frenatus*, *prasinus*, etc. It appears to me likely that this difference in some of the species may make it possible to subdivide the Genus which as it now stands is large and cumbersome. The rows anteriorly for some distance number 19, then at a point from one to five heads-lengths behind the head the 4th row above the ventrals (rarely the 5th) divides, the rows then remain 21 till some distance behind the middle of the body where they fall to 19 again owing to a coalescence of the 4th and 5th (rarely 3rd



3 Specimens of *Coluber cantoris.*
A 3rd Labial entire.
B ,, ,, partially divided.
C ,, ,, completely divided.

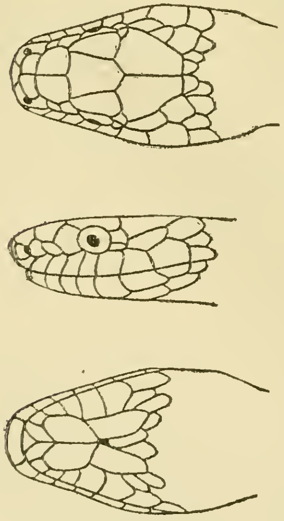
and 4th or 5th and 6th) rows above the ventrals. From 19 they again reduce almost simultaneously to 17 by a fusion of the 3rd and 4th or 4th and 5th rows. The anal was divided in one specimen only. Here again I cannot agree with Mr. Boulenger's designation of a subocular, and in this species the arguments in favour of my own view are very strong, for many specimens are to be seen with and many without this little shield. In some it is present on one side and not on the other, and a comparison of the two sides makes the origin of the shield obvious. In one example the 3rd labial is seen but partially divided, very clearly indicating that the so-called subocular is an integral part of this shield. I attach figures for comparison.

The iris of the specimen brought to me freshly killed was red, and the pupil horizontally subovate. The chin was ruddy, and the throat canary yellow. The posterior transverse bars were ruddy. In another specimen the sides of the throat were salmon, and the belly behind pinkish about the angulation of the ventrals.

Coluber tæniurus (Cope).

I obtained two specimens from Pashok, and saw another in the St. Joseph's College collection. In all specimens the costals were 23 from close behind the neck, to a point well behind midbody, where they became 21. The reduction to 21 is due to fusion of the 4th and 5th rows above the ventrals; from 21 to 19 to fusion of the 3rd and 4th rows. In one example they remained 19 nearly to the vent, in the other two they reduced to 17, more than two heads-lengths before the anus, the reduction being brought about by fusion of the 5th and 6th rows. The labials were 9, the 5th and 6th touching the eye, the 4th not divided. The ventrals and subcaudals were 246+100, 254+94 and 252+98. The anal was divided in all.

Coluber prasinus (Blyth).


Coluber prasinus, (nat. size).

Five specimens were collected, all from Pashok, and all young. The scales are 19 from just behind the neck to well behind midbody. The absorption of rows is interesting, and so different from many species now included in the genus that I think this alone may serve to further divide it. From 19 the rows soon become 15 by two fusions which occur close together, so that their order may be reversed. Usually the first from 19 to 17 is due to a fusion of the 3rd and 4th (rarely 4th and 5th) rows above the ventrals; the next from 17 to 15 is due to a coalescence of the two rows next to the vertebral on each side (not the vertebral itself).

Boulenger says the anal shield is rarely entire. I found it so in all the specimens, and also in one of the two in the Darjeeling Museum. I omitted to record it in the other. I found the ventrals as low as 193, and the subcaudals as high as 109.

Coluber radiatus.—Schlegel

6 examples, all from Pashok.

Dendrophis pictus.—Gmelin.

I obtained 6 specimens which I assign to this species,[*] three from Pashok, the rest from Pashok or Tindharia. The scales were 15 anteriorly and in midbody, and 11 or 9 at a point two heads-lengths before the anus. The ventrals and subcaudals were 203 + 140, 205 + 145, 191 + 145? 206 + ? and 204 + ? and 202 + 132, respectively. The vertebrals in midbody were as broad as long or rather broader. The anal was divided in all.

One specimen I saw in St. Joseph's College collection which I include here pro tem belongs, I consider, to a species as yet not described. In this the anal was entire, the ventrals and subcaudals 187+151, and the scale rows 15 anteriorly and in midbody, 9 behind at a point two heads-lengths before the anus. The vertebrals at midbody were a shade longer than broad. This specimen appears to me to agree in every way with a large series of specimens I have collected in Assam and two others I have had from Jalpaiguri in all of which the anal is entire. This last is a noteworthy feature for no other of the species of *Dendrophis* and *Dendrelaphis* hitherto described is similarly distinguished. In a future paper on the snakes of Assam I intend to refer to it as new species under the title *proarchos.*

Dendrelaphis tristris.—Daudin.

Six specimens which I think there can be no doubt are of this species[†] were received, two from Tindharia, the rest from Pashok. Another similar specimen I found in the Darjeeling Museum. In these the costals anteriorly and in midbody were 15, at a point two heads-lengths before the anus 9 in ♂, 1 in ♀. The vertebrals in midbody were about $\frac{2}{3}$ to $\frac{3}{4}$ as broad as long, and the ventrals and subcaudals noted were 190+132, 191+145, and 192+151, respectively. The anal was divided in all. This species and the last are in general appearance, and the details of their lepidosis extremely alike. The differences I see between them are as follows :—In *tristris* there is a small light interparietal spot, and a light vertebral stripe anteriorly. The 2nd, 3rd and 4th supralabials (the 1st also sometimes) have narrow black posterior margins. There is a short, narrow rather indistinct postocular stripe. There are black interrupted oblique stripes on the sides of the forebody arranged in pairs. Two supralabials only, *viz.*, the 5th and 6th touch the eye. The vertebral row develops gradually on the nape, and in midbody the length of each shield exceeds the breadth. The maxillary teeth number 16 to 19, and the most posterior are rather smaller than the preceding. The nasal bones are of a distinct shape.

In *pictus* there is no interparietal light spot, no vertebral light stripe anteriorly, and no oblique black stripes on the sides of the forebody. None of the supralabials show black posterior margins There is a broad black conspicuous band from the eye continued well down the body. Three supralabials usually touch the eye, *viz.*, the 4th, 5th and 6th. The vertebral enlargement is sudden and due to the confluence of two or three scales on the nape. The vertebral shields in midbody are as broad as long or broader. The maxillary teeth number 20 to 23, and the most posterior are compressed, and rather longer than the preceding. The nasal bones too are distinct in form.

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[*] I have prepared 3 skulls from these.

[†] I have prepared 5 skulls from these, and all are undoubtedly typical of this Genus.

Simotes cyclurus.—Cantor.

I got two specimens from Tindharia and saw one in St. Joseph's College collection. All belong to variety B of Boulenger's Catalogue. In one of my specimens the costals were 19 in anterior and midbody, 17 at a point two heads-lengths before the anus. In the other the lepidosis was very peculiar, the costals being 17 anteriorly becoming 19, and then again 17 and 19 several times over; 19 in midbody, and 15 behind at a point two heads-lengths before the anus. As in *Zaocys* and some *Zamenis*, I consider that the 3rd supralabial is divided in this snake, and therefore touches the eye as well as the 4th and 5th shields of that series. The upper division of this shield is misnamed a subocular.

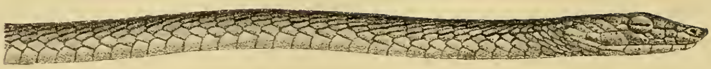
Simotes albocinctus.—Cantor.

Of 38 specimens received, 25 were from Pashok, 12 from Tindharia and 1 from Darjeeling; 26 of these were of the A variety of Boulenger's Catalogue, *i.e.*, *typica*, 16 being from Pashok and 10 from Tindharia. 11 examples belonged to variety C of Boulenger's Catalogue, 9 of these being from Pashok and 2 from Tindharia. My Darjeeling specimen was also of this variety.

The two varieties are very distinct, so much so that to one unacquainted with the subject of ophiology they would certainly be taken to be different species. I have never seen any forms connecting the two.

In variety A there is a great variation in the ground colour which varies irrespective of age from a dark-brown to a bright berry-red, this latter hue being especially bright in the flanks. In more than one specimen the colour was a very beautiful shade of pink very like that of a boiled prawn. There are from 21 to 25 light, dark-edged, conspicuous and well defined cross-bars on the body, 5 to 8 on the tail. These are narrow, and end laterally close to the ventrals. In light specimens they are quite white, in darker specimens buff, or more often ashy-grey, and often bordered with black. In some of the specimens, the brown ones especially, longitudinal streaks may be more or less distinctly traceable. These resemble those in *cyclurus* consisting of an upper broad dark band 4 or 5 scales broad, and separated more or less distinctly by a light vertebral streak, and a lower narrow dark band on the 3rd and 4th or 4th and 5th rows above the ventrals.

In the dark specimens the usual sagittate *Simotes* markings are blackish-brown, but in light specimens they are light edged with blackish. In the



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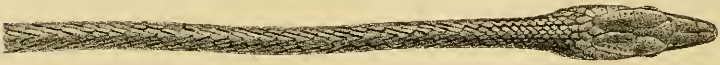

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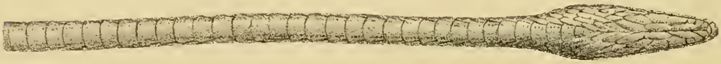

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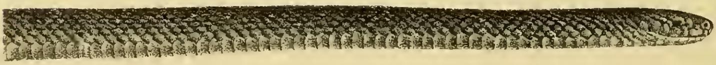

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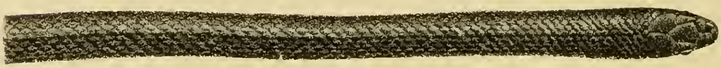

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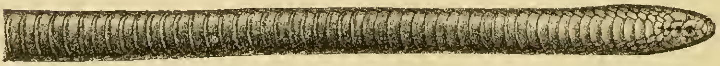

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J.Green del.et lith.

1–3. Dryophis fronticinctus 4–6. Oligodon melaneus.

prawn-coloured specimens they are quite white. In the reddish specimens there is usually some mottling of red or pink on the belly.

In variety C I never saw any ruddy tinge in the ground colour which was of various shades of brown. The marks on the back, 23 to 34 on the body and 6 to 8 on the tail, are very distinctive in form, and similar to those seen in *Simotes splendidus*, *Oligodon venustus* and some other species of these genera. They are of a darker brown than the ground and their anterior and posterior borders are more or less indented in the vertebral line, sometimes causing complete bisection. More often they are merely indented to produce a walnut shaped mark thus × I usually refer to this variety in my notebooks as *juglandifer* from the shape of these marks. Sometimes outside each of these marks is a smaller dark spot. In the dark specimens the shape of these marks cannot always be determined. In some examples there are longitudinal streaks exactly similar to those already mentioned under the last variety, but usually even more obscure. In other specimens the ground colour is variegated with short oblique light and dark streaks a scale long as one sees in *Oligodon subgriseus*, *Simotes theobaldi* and some other species of these genera.

In some of these specimens I noticed a more or less distinct dark cross bar between each or some of the walnut marks.

Lepidosis.—I can find no differences in the lepidosis of these two varieties, which must therefore remain as varieties rather than species. The scale rows were 19 in all the specimens in the anterior and midbody. At a point two heads-lengths before the anus they were 15, except in 3 examples where they only reduced to 17. All of these exceptions were from Pashok, one was variety A and the two others variety C. I found the labials 8 with the 4th and 5th touching the eye in one example. The 2nd labial which is usually divided was entire in one specimen. In another the 3rd and 4th subcaudals were entire. The ventrals vary from 188 to 206 and the subcaudals from 50 to 68.

Food.—I found a mouse had been taken once. The tail of a mouse was found in the stomach of another, and in a third there was a mass of soil with small stones, shreds of vegetable fibre and two longish hairs—probably horse-hairs.

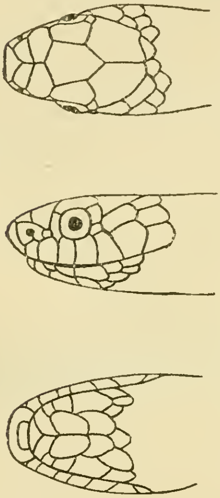
It is obviously one of the commonest snakes in this part of the Himalayas. It rarely ascends above 5,000 feet. Mr. de Abreu, who has collected snakes at Kurseong for some years, told me he only once got this species. It not infrequently descends to the level of the Plains though it is essentially a mountain snake. Variety *typica* appears to prefer the lower slopes to these of higher elevation, but *juglandifer* seems to be the more common variety at the upper limits of its habitat.

Oligodon melaneus, Spec. nov.

(See Plate figs. 4, 5 and 6.)

Two specimens, a ♂ and a ♀, were collected at the same time at Tindharia, probably in company, in July. They very obviously constitute a species hitherto unknown, which I think should be referred to the genus *Oligodon*. The ♀ was gravid, and contained 4 eggs varying from ½ to ⅝ inch in length. She measured 13⅛ inches, the tail accounting for 1¾ inches. I have omitted to record the length of the ♂, which was very similar. One was presented to the British Museum, the other to the Indian Museum.

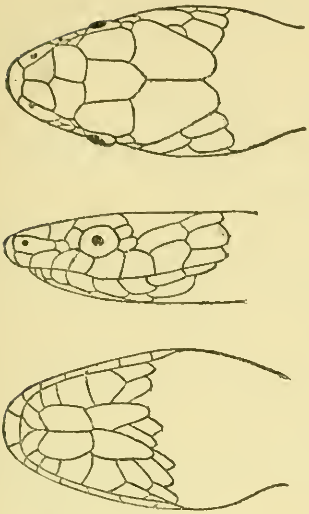
Description.—*Rostral.*—Touches 6 shields; the nasal sutures are equal to, or rather greater than, the internasals, and about twice the 1st labials; the portion visible above equal or less than the distance from it to the frontal. *Internasals.*—Two; the suture between them equals that between the præfrontal fellows; less than half the internasopræfrontal sutures. *Præfrontals.*—Two; the suture between them about half the præfronto-frontal; in contact with internasals, postnasals, loreals, præoculars, and supraoculars. *Frontal.*—Touches 6 shields, the sutures of which are subequal; longer than parietals. *Supraoculars.*—Length about three-fourths, breadth about one-third that of the frontal. *Nasals*—Semidivided; in contact with the 1st labial only in the ♂, with the 2nd also in the ♀. *Loreals.*—One, small, about half to one-third the length of the nasals. *Præoculars.*—One. *Postoculars.*—Two. *Temporals.*—One anterior. *Supralabials.*—7 with the 3rd and 4th touching the eye on both sides in the ♂ and on the left side in the ♀, the 4th and 5th touching the eye on the right side in the ♀. *Infralabials.* 4, the 4th largest and in contact with 2 or 3 scales behind; the suture between the 1st rather longer than that between the anterior sublinguals. *Sublinguals.*—Two pairs, the posterior about three-fourths the anterior, and touching the 4th only of the infralabial series. *Costals.*—15 in the whole body length; vertebrals not enlarged; the last row about twice as broad as the vertebrals; no keels; no apical pits. *Ventrals.*—152 in the ♂, 159 in the ♀. *Anal.*—Divided in the ♀, entire with a basal indication of a division in the ♂. *Subcaudals.*—Divided; 42 in the ♂, 40 in the ♀. *Colour.*—Uniformly blackish above merging to greyish in the flanks. Discerned closely it is seen to be very finely speckled with black on a grey ground. Beneath, the ♂ is uniformly blue-grey of a beautiful shade; the ♀ is of the same shade but specked with black. The grey fades to whitish on the chin and both lips. Eye with round pupil.



Oligodon melaneus (× 2).

Ablabes stoliczkæ.—Sclater.

In the Darjeeling Museum I found two specimens of this little known and apparently rare snake of which but 3 specimens have been previously recorded. These were from the Naga Hills, Assam; Samaguting and Bia-po in the Karen Hills of Upper Burma. The habitat is now extended to the Eastern Himalayas.



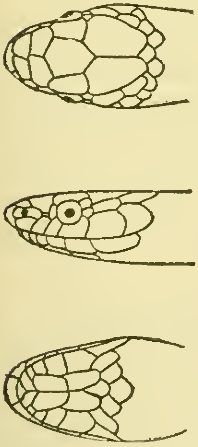
Ablabes stoliczkæ (× 2).

Lepidosis.—The costals are in 15 rows in the anterior and middle parts of the body 13 behind; the reduction being effected by an absorption of the 3rd row above the ventrals into either of the adjacent rows. The ventrals and subcaudals are 148 + 131 and 152 + ?, the tail imperfect. The loreal in one specimen is completely confluent with the postnasal forming an elongate shield in contact with the first 3 supralabials. The 3rd labial in the other specimen does not touch the nasal. The colour is uniform and putty-like above, white beneath with an indistinct, ill-defined, fawn, lateral line. A blackish streak passes from the lore, and behind the eye to be lost in the neck.

Ablabes rappi.—Günther.

All the 16 specimens collected were from the lower elevations, 5 being from Tindharia and 10 from Pashok. In 1 the locality was not recorded.

My largest was 1 foot $3\frac{1}{8}$ inches long.



Ablabes rappi (× 2).

Lepidosis.—The costals number 15 in the whole body length. In one specimen however the 6th and 7th rows above the ventrals repeatedly fused, and divided in the anterior parts of the body whilst the last two rows similarly united and divided several times posteriorly so that the rows varied accordingly from 15 to 13. The 5th (penultimate) supralabial is an unusually long shield which is very characteristic of this species. In one specimen the 5th and 6th were completely confluent on one side, and partly so on the other, and in a second partly confluent on one side. The last ventral was divided in one example, and the 1st, 2nd, 3rd, 5th and 6th subcaudals were entire in another. The loreal, normally small, was specially so in one specimen on one side, and absent on the other, so that the præfrontal touched the 2nd supralabial on that side. In another the loreal was so small on one side that the præfrontal met the 2nd supralabial in front of it. In one recently acquired specimen the belly was sulphur yellow, and I think it is probable that in life all the specimens may be yellow beneath. The dorsal yellow in the scales of many *Lycodon* and the ventral yellow of *Simotes cruentatus*, I know, fade to white almost at once in spirit. Boulenger says there is a double series of transverse dark spots anteriorly. I found three series usually, one mesial. On the other hand in two specimens at least, these spots were not visible at all, the dorsum being uniformly dark-brown.

Dipsadomorphus trigonatus (Schneider).

Two specimens were obtained from below Tindharia, both quite typical.

Dipsadomorphus hexagonotus (Blyth).

One of the commonest of Eastern Himalayan snakes at altitudes below about 5,000 feet. Of 72 examples, 67 were from Pashok, 5 from Tindharia.

Lepidosis.—The costals at a point two heads-lengths behind the head are in 21 rows normally (19 in two, soon becoming 21), 21 in midbody, and 15 at a point two heads-lengths before the anus (17 in one). The reduction of rows is very similar to that of other species in this genus and characteristic. The rows become 19 by the absorption of the uppermost row into the vertebral, then 17 very shortly afterwards by a confluence of the 3rd and 4th rows above the ventral. Finally some distance behind, the 17 become 15 by the absorption of the uppermost row into the vertebral. The first two steps in the reduction are occasionally reversed. The 3rd and 4th subcaudals were entire in one example. The supralabials were 9 with the 4th, 5th and 6th touching the eye in one example on one side. The ventrals were 223 to 247, the subcaudals from 100 to 119.

Food.—In two specimens I found an agamoid lizard, probably a *Calotes,* had been swallowed and twice another lizard, *viz., Japalura variegata,* once a fledgling, and in another I found a mass of bird's eggs with light blue shells.

Many of the specimens had a remarkably ruddy shade in their tawny colouration, most accentuated towards the edge of the ventrals where it became a pinkish or salmon-red stripe. In two young specimens blackish oblique costal streaks were visible, in one faintly, in the other distinctly. The eye in many examples too (perhaps in all) was bright pink, reminding one of pink enamel and quite distinct from the effects produced by hæmorrhage into the eye from local injury.

Dipsadomorphus multifasciatus (Blyth).

Four specimens of this uncommon species were collected at Pashok. The largest was 3 feet 9½ inches, and the tail 10 inches in length.

Lepidosis.—The costals agree with those of *hexagonotus, trigonatus,* and others of the genus. There are normally 21 rows anteriorly, and in midbody, 15 behind at a point 2 heads-lengths before the anus. The rows become 19 from the absorption of the uppermost into the vertebral. Very shortly afterwards they become 17 by a fusion of the 3rd and 4th rows above the ventrals, and then again 15 by an absorption of the uppermost row into the vertebral. One example was aberrant in a manner strictly comparable to what obtains in rare examples of other species of this genus. The vertebral row divides into three, reunites and again divides several times so that the scale rows become alternately 19 and 21. The ventrals and subcaudals were 228+109, 223+111, 245+115 and

238+106. The præoculars were two in one example, two on one side, three on the other in the second specimen. One example had swallowed a lizard of the species *Japalura variegata.*

Dipsadomorphus cyaneus (Duméril et Bibron).

One fine specimen was sent me from Tindharia. As in most of the species of this genus the costals are 21 anteriorly, and fall to 15. The reduction of rows is effected by the same fusion as in *hexagonotus* and others (*q. v.*) The ventrals and subcaudals were 254+124, the tail being slightly docked. The mucous membrane of the mouth is quite black in this snake, extending on the roof of the gullet for some 5 or 6 inches in this specimen, then breaking up into a coarse mottling and disappearing. This black is not seen in any of the other green snakes I know of the genera *Dryophis, Coluber*, or *Lachesis*, in all of which the mouth is white (pinkish in life).

Dipsadomorphus cynodon (Boie).

I obtained a fine example of this from Tindharia, conforming to Boulenger's variety B. The costals were 21 at a point two heads-lengths behind the head, 23 in midbody, and 15 at a point two heads-lengths before the anus. The reduction from 23 to 21, from 21 to 19, and from 17 to 15 is due to the absorption of the uppermost row into the vertebral. From 19 to 17 the 3rd and 4th rows above the ventrals coalesce on the left side, the 4th and 5th on the right. The ventrals were 256, the tail imperfect. This species is known from the Plains, and is not to be considered a true Himalayan snake. I have had two other examples from the Jalpaiguri District, which with this specimen extend the previously recorded habitat.

Psammodynastes pulverulentus (Boie).

Of 15 specimens 4 were from Tindharia, 11 from Pashok. The ventrals range between 163 and 170, and the subcaudals between 52 and 63. I found the remains of a skink—probably a *Lygosoma* in the stomach of one. A ♀ captured between the 20th and 24th of September at Pashok was gravid, containing 10 eggs about half an inch long. It was 1 foot 7⅝ inches long. Many of the specimens had bright ochraceous spots or mottling in the flanks, and in one example these were so abundant as to form an ochraceous band.

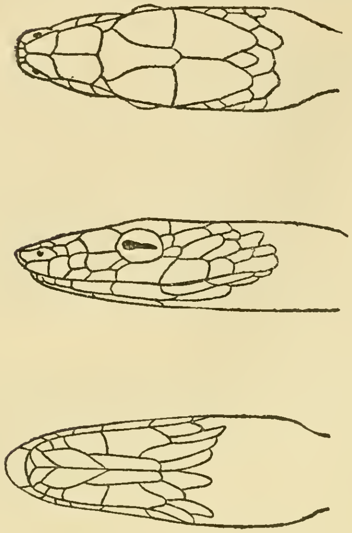
Dryophis prasinus.—Boie.

The only 6 specimens acquired were from Pashok. In all the scales were 15 anteriorly and in midbody, but 13 behind at a point two heads-lengths before the anus, the reduction arising from a fusion of the 3rd and 4th rows above the ventrals. In all the supralabials were 9 with the 4th, 5th and 6th touching the eye. The ventrals ranged from 197 to 201, and the subcaudals from 159 to 175. My largest was a ♀ 3 feet 7½ inches in length.

Dryophis fronticinctus.—(Günther).

See Plate, figs. 1, 2 and 3.

In the Darjeeling Museum I found a single specimen of a snake of this genus which I think must be assigned to *fronticinctus* but in case there is any doubt I describe and figure it.



Dryophis fronticinctus (× 2).

Description.—Rostral.—Touches 6 shields, the anterior nasal sutures are rather greater than the internasal, and about twice the 1st supralabials with no pointed appendage. *Internasals.*—Two; the suture between them three-fifths that between the præfrontal fellows, subequal to the internaso-præfrontal; in contact with the anterior loreal. *Præfrontals.*—Two; the suture between, them about twice the præfronto-frontal; in contact with the internasals, anterior and posterior loreals, præoculars, and frontal. *Frontal.*—Touches 8 shields; the fronto-supraocular sutures are about four times the length of the fronto-parietals. *Supraoculars.*—Nearly as long, and about three times the breadth of the frontal. *Nasals.*—Undivided; touch the 1st and 2nd supralabials. *Loreals*.—Two (1 + 1). *Præoculars.*—One, touching the frontal. *Postoculars.*—Two. *Temporals.*—Two anterior. *Supralabials.*—8, the 3rd, 4th and 5th touching the eye, the 3rd divided into an upper and a lower part and the 4th into two upper and one lower part. *Infralabials.*—5, the 5th much the largest and in contact with 3 scales behind. The suture between the 1st about three-fourths that between the anterior sublinguals. *Sublinguals.*—Two pairs; the posterior longer, and in contact with the 4th and 5th infralabials. *Costals.*—Anteriorly and in midbody 15, at a point two heads-lengths before the anus 13; the reduction is due to a confluence of the 4th and 5th rows above the ventrals on one side and the 5th and 6th on the other; the vertebrals rather enlarged; the lateral rows oblique; the last row enlarged; no keels; no apical pits. *Ventrals.*—196. *Anal.*—Divided. *Subcaudals.*—135; divided.

Colour.—Uniform khaki-brown above with a rather darker ill defined dorsal stripe. In the forebody there are the usual black oblique marks seen in other species of this genus. No flank line. Beneath, buff with an obscure blackish lateral line on the ventrals, some ruddy streaks between these, and a median stripe of punctiform blackish spots. An obscure postocular streak. The specimen measured 2 feet 10 inches of which the tail accounted for $10\frac{3}{4}$ inches.

The only other *Dryophis* previously recorded from the Himalayas is *prasinus*. *Fronticinctus* has only once been recorded outside Burmese limits and the specimen which is from Sibsagar in Assam is in the Indian Museum. I have examined this and agree with Sclater's identification though it is aberrant in that the anal is entire, and the scales are 15 in the whole body length. In all the other species of this genus the nasal shield touches only the 1st of the suprabial series, and the internasal meets the 1st and 2nd supralabials. In *fronticinctus* the nasal touches the 1st and 2nd supralabials, and the internasal touches no supralabial owing to its contact with the anterior loreal.

The habitat is now still further extended into the Eastern Himalayas.

Bungarus lividus.—Cantor.

I obtained three specimens all from Tindharia, and examined another in the St. Joseph's College collection. The ventrals and subcaudals were as follows:—212 + 36, 211 + 35, 209 + 37 and 212 + 38. The vertebral row was but feebly enlarged in all on the body but quite as well developed on the tail as in other species of the genus where they are well developed on the body as *cæruleus*, *niger*, etc. The habitat of this species is now extended to the Eastern Himalayas.

Bungarus niger.—Spec. nov.

I acquired 8 specimens of a krait with which I have become familiar in Assam as a fairly common species in that locality. As the majority of the specimens I have seen come from that region, I am describing and figuring it in a paper on the snakes of Assam. Two of these specimens were from Tindharia, four from Pashok and two dubiously from either Pashok or Tindharia. The ventrals ranged between 221 and 231, and the subcaudals from 51 to 57. The vertebrals are as much enlarged as in *cæruleus*, being as broad or broader than long. It is completely black dorsally like *lividus* but is a larger snake. Two specimens measured just four feet.

Bungarus bungaroides (Cantor).

I failed to obtain a specimen of this rare snake, but examined one in the Darjeeling Museum and two others in St. Joseph's College collection. The ventrals and subcaudals were 233 + 49, the 1st to the 4th of the latter entire; 232 + 51, the 2nd to the 6th of the latter entire; and 238 + 48, the 2nd subcaudal only entire. The black bands are mostly complete as in the species *fasciatus* and *ceylonicus*. Mr. de Abreu told me he had but once acquired this snake at Kurseong during five years' collecting. This was found after dark in a bathroom of one of the boys at Victoria School. The ventrals and subcaudals were 237 + 51, the 3rd, 4th and 5th only of the latter entire.

Naia tripudians.—Merrem.

Nine examples were received, eight from Pashok, the ninth from either Pashok or Tindharia. All belonged to variety *fasciata* (Gray).

Naia bungarus.—Schlegel.

I obtained no specimen, but examined one in the Darjeeling Museum and two in St. Joseph's College collection. The costals in all are 17 at a point two heads-lengths behind the head, 15 at midbody, and at a point two heads-lengths before the anus 15. The rows become 15 owing to a fusion of the 3rd and 4th rows above the ventrals. The ventrals and subcaudals were 237 + 80 ?: 239+91, the first of the latter entire; 250+80, the first 7 subcaudals entire.

Callophis macclellandi (Reinhardt).

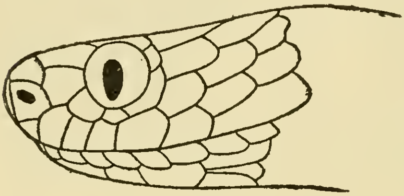
Four specimens were all from Pashok. I examined another in the Darjeeling Museum and two others in St. Joseph's College collection. All were of variety *univirgatus* (Günther). The costal rows are 13 in the whole body length. The ventrals ranged between 199 and 222, the subcaudals between 27 and 32. The last ventral was divided in one. There were from 23 to 32 black rings on the body, 4 on the tail. Some of the first and last rings on the body are complete in some specimens, the rest incomplete, not meeting the black vertebral stripe.

AMBLYCEPHALIDÆ.

Amblycephalus monticola (Cantor).

All ten specimens collected were from Pashok, the largest measuring 2 feet 3¼ inches.

Lepidosis.—The costals are in 15 rows in the whole length of the body, and the vertebrals but slightly enlarged, the enlargement beginning gradually, and not due to a confluence of shields on the spine. Boulenger says that the 4th or 4th and 5th supralabials touch the eye, and shows this in his figures in the Fauna of British India Reptilia and Batrachia (p. 415) and in his Catalogue, Vol. III, plate XXIII, figure 1. I have now seen nearly twenty examples, and have only once found a supralabial, *viz.*, the 4th, touching the eye. I find the shield surrounding the eye behind and below subject to much variable division. In Boulenger's figure in the Fauna of British India he shows but one supralabial, *viz.*, the 1st, as touching the nasal. This is incorrect, the 2nd also invariably touches that shield. The supralabials are peculiar in the great length of the last of the series which is as long as the preceding two or three shields. The ventrals and subcaudals noted were 184+70, 184+70, and 186+70.



Amblycephalus monticola (× 2).

Food.—In the stomach of one I found five small snails, one with the shell quite perfect, the others with vestiges of shell adhering. In three or four others there were small snails without shells of what appeared to me the same species as in the first case. Slugs appear to be the staple diet of this species, for in the Khasi Hills last year I noted large slugs taken on two occasions.

VIPERIDÆ.

Lachesis monticola (Günther).

Of 23 specimens, 15 were from Pashok, 7 from Tindharia, and 1 from Darjeeling. I examined several others in the two local collections.

Lepidosis.—The costals are usually in 23 rows anteriorly and in midbody, and 19 at a point two heads-lengths before the anus. In two specimens at a point two heads-lengths behind the head they were 25, where in midbody they were 23. In only two examples were the scales 25 in midbody, and in both they were 25 anteriorly also. In one of these they fell to 19 behind and in the other only to 21. The ventrals varied from 140 to 151, the subcaudals 32 to 47. In one the last 3 subcaudals were entire, in another the 41st, 42nd, 46th and 47th; in a third the 2nd to the 6th were entire.

Food.—It appears to subsist chiefly on mammals. In one a tuft of fur was protruding from the anus, in three others there were large masses of fur in the cloaca, and two had swallowed a mouse. It is a common snake between elevations of about 4,000 to 8,000 feet.

Lachesis gramineus (Shaw).

I acquired 12 specimens, 6 from Pashok, 3 from Tindharia, and 3 were dubiously from one or other of these localities.

Lepidosis.—In all the costals were in 21 rows anteriorly and in midbody, 15 behind. In the three steps where the rows reduce, it is the 4th and 5th, or 5th and 6th rows above the ventrals that coalesce. The ventrals ranged between 162 and 171, the subcaudals between 57 and 70. The 1st supralabial was divided into an upper and a lower part on one side in one example. I noted last year in *L. monticola* that the anal glands secrete a limpid fluid which on pressure at the base of the tail spurts out as a very thin stream such as issues from the needle of a hypodermic syringe. I found an exactly similar secretion in the glands of this species, and it is remarkably abundant, for the stream continues with some force for two or three seconds or more. It has a peculiar odour, not exactly disagreeable, which recalled to my recollection the distinctive smell I had noted last year in *monticola*.

Colour.—I have never seen such extremely beautiful specimens of this snake as I saw this year. The dorsum is the most brilliant of foliage greens, and where the scales are overlapped the colour is intense sky-blue. In some there is no vestige of a flank line, in others this was obscurely indicated by a whitish streak on the upper edge of each scale in the ultimate row. In others again a very conspicuous enamel white line adorned the last row, but the most beautiful ornamentation consisted of a double line along the last row, white below, and liver colour or crushed strawberry above. In one these colours were pink below, pale-blue above. The belly was usually intense light green but in some specimens hedge-sparrow-egg-blue. The head was green above, fading to sky-blue or pale greenish or white on the lips and chin. Above the tail tip there was more or less blotching with pinkish-brown or red. The eye in most (perhaps all) specimens was an opaque pink like enamel. This had nothing to do with hæmorrhage into the eye from injury.

Food.—I found a mouse in the stomach of one.

The hill-men told me it is called by them "Sirisi samp." It is a common snake on the lower slopes below about 5,000 feet.

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SOME RANGOON BIRDS.

BY

MAJOR H. H. HARINGTON (*92nd Punjabis*).

The following is a short list of birds, noticed or collected by myself and Mr. P. F. Wickham in or near Rangoon. The majority were procured along the Prome Road as far as Taukchan (20 miles), either during Military Training, or on one or two occasions of a few days' leave.

The list is very small and incomplete, but may be of use or interest to any one in Rangoon, wishing to know what birds are likely to be met with.

Those marked with an asterisk were actually collected and skins sent home by me, the others noticed.

1. (4) *Corvus macrorhynchus.*—(The Jungle Crow.)

An early breeder, I got a koel's egg from a nest in February.

Burmese name—Taw-chegan.

2. (8) *Corvus insolens.*—(The Burmese House Crow.)

A regular pest in Rangoon ; begins nesting operations in April.

Burmese name.—Chegan.

* 3. (12) *Urocissa occipitalis.*—(The Red-billed Blue Magpie.)

Wickham found a nest at Taukchan on the 15th April. Fairly plentiful in thick jungle.

* 4. (16) *Dendrocitta rufa.*—(The Indian Tree-pie.)

Fairly common, and is probably a late breeder. I procured a three-quarter grown bird on the 1st January.

* 5. (21) *Crypsirhina varians.*—(The Black Racket-tailed Magpie.)—Very plentiful around the outskirts of Rangoon, and has notes very like those of the last. Both Wickham and myself were unfortunate over getting the eggs of this bird. I found three nests in July but none had eggs. My Burman, however, got one containing a single one. Nests composed of twigs and curled tendrils of some creeper.

Burmese name.—Ami-whine.

* 6. (70) *Garrulax belangeri.*—(The Burmese White-crested Laughing-Thrush.)

Very common and noisy. Breeds from April on to August.

Burmese name for all Laughing Thrushes.—Way-aung-hnet.

* 7. (72) *Garrulax pectoralis.*—(The Black-gorgeted Laughing-Thrush.)

Nearly as plentiful as the last. Breeds from April to August. In June I procured a nest containing 3 eggs and one of *C. coromandus*, the Red-winged Cuckoo.

8. (73) *Garrulax moniliger.*—(The Necklaced Laughing-Thrush.)

Not so common as the last. I also found a nest of this bird containing two eggs of *C coromandus* and 3 of its own.

9. (134) *Timelia jerdoni.*—(The Red-capped Babbler.)

Haunts long grass in deep nullahs and is a noisy little bird when disturbed. I did not find its nest.

10. (145) *Pellorneum subochraceum.*—(The Burmese Spotted Babbler.)

A noisy little bird, to be heard in all months of the year, and has a monotonous call of " Betty dear " " Betty dear."

Wickham found several nests from April on, so it evidently has two broods in the year.

11. (160) *Turdinus abbotti.*—(Abbott's Babbler.)

Breeds April and May. One nest containing a single egg in February.

12. (176) *Mixornis rubricapillus.*—(The Yellow-breasted Babbler.)

This bird probably is found round Rangoon, as I think I have heard its call, and probably has two broods in the year as Wickham got a nest at Pegu in August.

13. (243) *Ægithina tiphia.*—(The Common Iora.)—Very common, every compound having one or two pairs, and breeds from April onwards. Wickham got several nests in that month.

Burmese name.—Shwe-pi-so.

14. (279) *Molpastes burmanicus.*—(The Burmese Red-vented Bulbul.)

Very common, breeds from April to August.

Burmese name for all Bulbuls.—Boh-kha-lone.

15. (288) *Otocompsa emeria.*—(The Bengal Red-whiskered Bulbul.)

Nearly as common as the last.

16. (290) *Otocompsa flaviventris.*—(The Black-crested Yellow Bulbul.)

Fairly plentiful. Coming into compounds during the cold weather.

17. (300) *Pycnonotus davisoni.*—(Davison's Striped-throated Bulbul.)

Not uncommon. I was unsuccessful in getting the eggs of this bird.

18. (306) *Pycnonotus blanfordi.*—(Blanford's Bulbul.)

I saw a few birds along the Prome road in the more open parts.

Burmese name.—Boh-sa-mwe.

19. (310) *Micropus melanocephalus.*—(The Black-headed Bulbul.)

One specimen procured.

20. (327) *Dicrurus ater.*—(The King-Crow.)

Very common.

Burmese name.—Lin-mi-swe.

21. (333) *Dicrurus cineraceus.*—(The Grey Drongo.)

A cold weather visitor.

* 22. (340) *Dissemurus paradiseus.*—(The Larger Racket-tailed Drongo.)

Fairly common in well wooded localities. I have seen it near Cantonments. It is a great mimic and has very fine notes which may be heard early in the morning and just before dark. Breeds from May to June.

Burmese name.—Lin-mi-swe-ami ne-qua.

23. (374) *Orthotomus sutorius.*—(The Tailor-Bird.)

Very common, breeds throughout the rains. Nests at all heights from the ground, building in crotons, in verandahs, and in trees 20 feet from the ground.

* 24. (381) *Cisticola cursitans.*—(The Rufous Fantailed-Warbler.)

Common round paddy-fields, and has probably two or more broods in the year, as I found birds nesting on our range in February.

Burmese name.—Na-pyi-sot.

* 25. (382) *Franklnia gracilis.*—(Franklin's Wren-Warbler.)

Fairly common in open jungle.

* 26. (393) *Arundinax aëdon*—(The Thick-billed Warbler.)

I procured a fully fledged young bird of this species in March on our Range. The bird must therefore breed there.

27. (463) *Prinia flaviventris.*—(The Yellow-bellied Wren-Warbler.)

I saw several birds near Monkey Point during the rains, but had no opportunity to look for nests.

* 28. (468) *Prinia blanfordi.*—(The Burmese Wren-Warbler.)

Very common along the railway embankments, breeding throughout the rains.

* 29. (481) *Lanius cristatus.*—(The Brown Shrike.)

Common cold weather visitor, very noisy at nightfall.

Burmese name.—Nya-zayet.

* 30. (488) *Tephrodornis pondicerianus.*—(The Common Wood-Shrike.)

* 31. (491) *Pericrocotus fraterculus.*—(The Burmese Scarlet Minivet.)

* 32. (500) *Pericrocotus perigrinus.*—(The Small Minivet.)

* 33. (506) *Campophaga melanoptera.*—(The Pale-grey Cuckoo-Shrike.)

I procured specimens of the above, but never had a chance of getting out to look for their nests.

34. (510) *Graucalus macii.*—(The Large Cuckoo-Shrike.)

May often be heard in Cantonments.

35. (512) *Artamus fuscus.*—(The Ashy Swallow-Shrike.)

I saw several during the cold weather at Hlawga.

* 36. (524) *Eulabes intermedia.*—(The Indian Grackle.) Talking Myna.

I heard them several times at Taukchan.

* 37. (538) *Sturnia malabarica.*—(The Grey-headed Myna.)

Fairly common.

38. (549) *Acridotheres tristis.*—(The Common Myna).
A regular nuisance round one's bungalows.

39. (552) *Æthiopsar fuscus.*—(The Jungle Myna.)
Common. A few near in bungalows disputing corners with the last.

40. (556) *Sturnopastor superciliaris.* (The Burmese Pied Myna.)
Very common.
Burmese name for all Mynas.—Zayet.

41. (575) *Cyornis rubeculoides.*—(The Blue-throated Flycatcher.)
A cold weather visitor.

42. (579) *Stoparola melanops.*—(The Verditer Flycatcher.)
Cold weather visitor.

43. (588) *Alseonax latirostris.*—(The Brown Flycatcher.)
Cold weather visitor.

44. (592) *Culicicapa ceylonensis.*—(The Grey-headed Flycatcher.)
Fairly common and occasionally very noisy.

45. (599) *Terpsiphone affinis.*—(The Burmese Paradise Flycatcher.)
One specimen.

46. (601) *Hypothymis azurea.* –(The Indian Black-naped Flycatcher.)
Common in many compounds and very noisy.

47. (608) *Pratincola caprata.*—(The Pied Bush-Chat.)
A cold weather visitor.

48. (610) *Pratincola maura.*—(The Indian Bush-Chat.)
Cold weather visitor.

49. (663) *Copsychus saularis.*—(The Magpie-Robin.)
Common in all compounds.
Burmese name.—Tha-baik-lwè.

50. (664) *Cittocincla macrura.*—(The Shama.)
Plentiful on the well wooded nullahs along the Prone Road.
Burmese name.—Taw-tha-baik-lwè.

51. (721) *Ploceus atrigula.*—(The Eastern Baya.)
Common, breeding throughout the rains.

52. (723) *Ploceus manyar.*—(The Striated Weaver-bird.)
Common.

53. (724) *Ploceëlla javanensis.*—(The Golden Weaver-bird.)
Common, breeding throughout the rains. The first nests I found were in a garden near Hlawga Station and were built in Hibiscus bushes, the birds first stripping the twiggs bare of leaves and flowers.

54. (726) *Munia atricapilla.*—(The Chestnut-bellied Munia.)
Common near water.

55. (735) *Uroloncha punctulata.*—(The Spotted Munia.)
Common.

56. (776) *Passer domesticus.*—(The Common Sparrow.)
Not so common as the next.
Burmese name.—Sa.

57. (779) *Passer montanus.*—(The Tree-Sparrow.)

Partially migratory, disappearing in the middle of the rains, returning in November, when it at once sets to work on its nesting operations, littering the place with grass.

58. (781) *Passer flaveolus.*—(The Pegu Sparrow.)

A few pairs to be seen in Cantonments.

59. (809) *Cotile sinensis.*—(The Indian Sand-Martin.)

Found no signs of their breeding near Rangoon, fancy no suitable sandbanks available.

60. (813) *Hirundo rustica.*—(The Swallow.)

Cold weather visitor.

61. (818) *Hirundo smithii.*—(The Wire-tailed Swallow.)

Found no signs of their nesting.

* 62. (839) *Limonidromus indicus.*—(The Forest-Wagtail.)

A rare cold weather visitor.

63. (847) *Anthus rufulus.*—(The Indian Pipit.)

64. (861) *Alauda gulgula.*—(The Indian Sky-Lark.)

Can be heard singing at Kokine.

65. (895) *Arachnechthra asiatica.*—(The Purple Sun-bird.)

* 66. (898) *Arachnechthra flammaxiltiaris.*—(The Burmese Yellow-breasted Sun-bird.)

I think this is the commonest of the two and probably breeds throughout the year. I found a nest with young in February and one building in the same month but failed to get their eggs.

* 67. (909) *Arachnothera longirostris.*—(The Little Spider-hunter.)

One specimen.

* 68. (911) *Chalcoparia phœnicotis.*—(The Ruby-Cheek.)

Common.

* 69. (912) *Dicæum cruentatum.*—(The Scarlet-backed Flower-pecker.)

Common.

* 70. (928) *Pitta oatesi*—(The Fulvous Pitta.)

Procured one or two specimens ; disappears during the rains.

* 71. (931) *Pitta cyanoptera.*—(The Lesser Blue-winged Pitta.)

Breeds in July. Wickham procured several nests.

* 72. (950) *Gecinus occipitalis.*—(The Black-naped Green Wood-pecker.)

* 73. (970) *Dendrocopus pectoralis.*—(The Spotted-breasted Pied Woodpecker.)

Often to be heard late in the evenings in Cantonments ; has a very low note ; when once heard easily recognisable.

* 74. (983) *Micropternus phæoceps.*—(The Northern Rufous Wood-pecker.)

* 75. (992) *Chrysocolaptes gutticristatus.*—(Tickell's Golden-backed) Woodpecker.)

* 76. (995) *Hemicercus canente.*—(The Heart-spotted Woodpecker.)

I did not find any woodpecker's nests during my stay in Rangoon.

Burmese name for all Woodpeckers.—Thit-kouk.

* 77. (1009) *Thereiceryx lineatus.*—(The Lineated Barbet.)

Very common and noisy throughout the year.

* 78. (1019) *Xantholæma hæmatocephala.*—(The Coppersmith.)

Common, to be heard calling every day in Cantonments; breeds in March.

* 79. (1023) *Coracias affinis.*—(The Burmese Roller.) Blue Jay.

Very common, breeds in March.

Burmese name.—Hgnet-kha.

80. (1026) *Merops viridis.*—(The Common Indian Bee-eater.)

Very common, and an early breeder.

81. (1027) *Merops philippinus.*—(The Blue-Tailed Bee-eater.)

Only a cold weather visitor, appearing towards the ends of the rains.

82. (1035) *Alcedo ispidsa.*—(The Common Kingfisher.)

Common.

* 83. (1040) *Ceyx tridactyla.*—(Three-toed Kingfisher).

One specimen, Taukchan.

84. (1043) *Pelargopsis gurial.*—(The Brown-headed Stork-billed Kingfisher.)

Have seen it on the Rangoon lakes.

85. (1044) *Halcyon smyrnensis.*—(The White-breasted Kingfisher.)

Very common and noisy, to be seen in many compounds; breeds in May.

86. (1051) *Dichoceros bicornis.*—(The Great Hornbill.)

* 87. (1053) *Anthracoceros albirostris.*—(The Indo-Burmese Pied Hornbill.)

Have seen both hornbills at Taukchan.

Burmese name—Auk-gyin.

* 88. (1067) *Upupa indica.*—(The Indian Hoopoe).

Fairly common; I did not find a nest.

Burmese name—Taung-pi-sot.

89. (1074) *Cypselus subfurcatus.*—(The Malay House-Swift.)

Breeds in the B. I. Barracks.

90. (1076) *Tachornis infumatus.*—(The Eastern Palm-Swift.)

Common everywhere, where palm trees exist.

Burmese name.—Pyan-hlwa.

* 91. (1095) *Caprimulgus indicus.*—(The Jungle Nightjar.)

Burmese name.—Myè-woot.

* 92. (1101) *Harpactes erythrocephalus.*—(The Red-headed Trogon.)

Breeds in June.

* 93. (1107) *Cuculus micropterus.*—(The Indian Cuckoo.)

* 94. (1108) *Hierococcyx sparverioidies.*—(The Large Hawk-Cuckoo.)

* 95. (1119) *Coccystes coromandus.*—(The Red-winged Crested Cuckoo.)

Breeds in July ; eggs found in nests of *G. pectoralis* and *G. moniliger*.

96. (1120) *Eudynamis honorata.*—(The Koel.)

A common pest during the hot weather.

* 97. (1123) *Rhopodytes tristis.*—(The Large Green-billed Malkoha.)

Breeds in June.

* 98. (1130) *Centropus sinensis.*—(The Common Coucal.)

Breeds during the rains.

Burmese name—Bok.

* 99. (1133) *Centropus bengalensis.*—(The Lesser Coucal.)

Breeds in August.

100. (1136) *Palœornis indoburmanicus.*—(The Large Burmese Paroquet.)

Burmese name—Kyet-taw.

* 101. (1140) *Palœornis rosa.*—(The Eastern Blossom-headed Paroquet.)

Burmese name—Kyet-lein.

* 102. (1145) *Palœornis fasciatus.*—(The Red-breasted Paroquet.)

Common , breeds in March.

* 103. (1152) *Strtx javanica.*—(The Indian Barn-Owl.)

Plentiful in Cantonments.

* 104. (1164) *Ketupa zeylonensis.*—(The Brown Fish-Owl.)

* 105. (1178) *Scops bakkamœna.*—(The Collared Scops Owl.)

Breeds in February.

* 106. (1183) *Glaucidium cuculoides.*—(The Large Barred Owlet.)

Breeds in April.

107. (1189) *Pandion haliaëtus.*—(The Osprey.)

Cold weather visitor.

108. (1191) *Otogyps calvus.*—(The Black Vulture.)

109. (1196) *Peudogyps bengalensis.*—(The White-backed Vulture.)

The common vulture.

* 110. (1217) *Spilornis cheela.*—(The Crested Serpent-Eagle.)

Plentiful near paddy fields.

* 111. (1227) *Polioaëtus humilis.*—(Hodgson's Fishing-Eagle.)

One specimen procured in Cantonments.

112. (1228) *Haliastur indus.*—(The Brahminy Kite.)

Common.

113. (1229) *Milvus govinda.*—(The Common Kite.)

Appears at end of October and disappears at the beginning of the rains.

114. (1230) *Milvus melanotis.*—(The Large Indian Kite.)

There are certainly two kinds of kites to be seen during the dry-weather, but which I failed to identify.

* 115. (1236) *Circus melanoleucus.*—(The Pied Harrier.)

Cold weather.

* 116. (1244) *Astur badius.*—(The Sikra.)

Fairly common, very noisy sometimes in Cantonments. Breeds in April.

° 117. (1265) *Tinnunculus alaudarius.*—(The Kestrel.)

Cold weather visitor.

118. (1271) *Crocopus phœnicopterus.*—(The Bengal Green Pigeon.)
° 119. (1273) *Osmotreron phayrei.*—(The Ashy-headed Green Pigeon.)
120. (1284) *Carpophaga ænea.*—(The Imperial Pigeon.)
121. (1291) *Chalcophaps indica.*—(The Bronze-winged Dove.)
° 122. (1302) *Alsocomus puniceus.* (The Purple Wood-Pigeon.)

The above all to be found along the Prome Road.

123. (1308) *Turtur tigrinus.*—(The Malay Spotted Dove.)

Common.

124. (1311) *Œnopopelia tranquebarica.*—(The Red Turtle-Dove.)
125. (1328) *Gallus ferrugineus.*—(The Red Jungle-Fowl.)
° 126. (1367) *Arboricola brunneipectus.*—(The Brown-breasted Hill-Partridge.)

Breeds at Taukchan, in June.

127. (1382) *Turnix pugnax.*—(The Bustard-Quail.)
° 128. (1386) *Turnix blandfordi.*—(The Burmese Button-Quail.)
130. (1389) *Hypotænidia striata.*—(The Blue-breasted Banded Rail.)

Common.

130. (1401) *Amaurornis phœnicurus.*—(The White-breasted Water-hen.)

Common.

131. (1402) *Gallinula chloropus.*—(The Moorhen.)

Common.

132. (1403) *Gallicrex cinerea.*—(The Water-Cock.)
133. (1428) *Metopidius indicus.*—(The Bronze-winged Jacana.)
134. (1432) *Sarcogrammus atrinuchalis.*—(The Burmese Wattled Lapwing.)
135. (1482) *Scolopax rusticula.*—(The Woodcock.)

One shot by an officer in my Regiment near the Camp at the 8th mile stone, Prome Road.

136. (1485) *Gallinago stenura.*—(The Pintailed Snipe.)
137. (1488) *Rostratula capensis.*—(The Painted Snipe.)

Breeds in June and July.

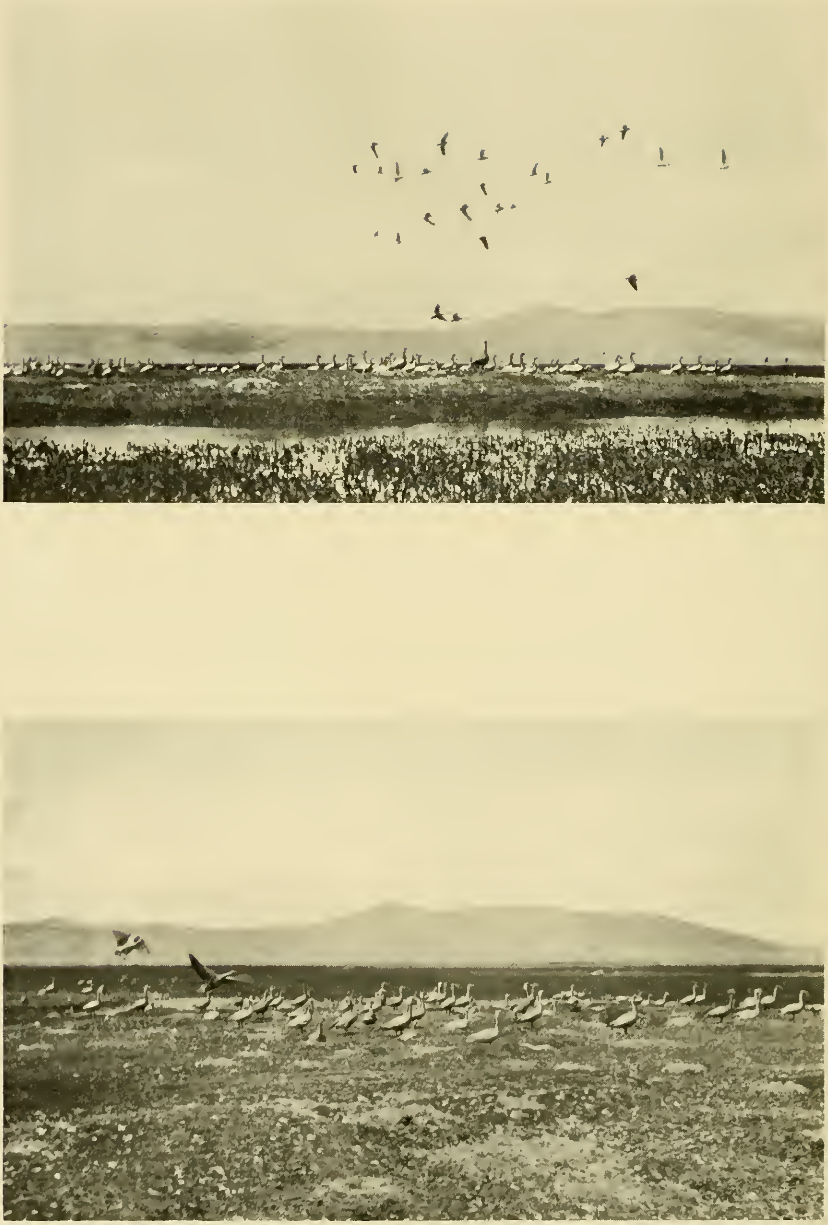
138. (1503) *Sterna seena.*—(The Indian River-Tern.)
139. (1504) *Sterna melanogaster.*—(The Black-bellied Tern.)
140. (1526) *Phalacrocorax carbo.*—(The Large Cormorant.)

A few used to breed at Hlawga in January.

141. (1527) *Phalacrocorax fuscicollis.*—(The Indian Shag.)
142. (1528) *Phalacrocorax javanicus.*—(The Little Cormorant.)
143. (1529) *Plotus melanogaster.*—(The Snake-Bird.)
144. (1555) *Ardea cinerea.*—(The Common Heron.)
145. (1559) *Herodias alba.*—(The Large Egret.)

146. (1561) *Herodias garzetta.*—(THE LITTLE EGRET.)
147. (1562) *Bubulcus coromandus.*—(THE CATTLE EGRET.)
148. (1565) *Ardeola grayi* —(THE POND HERON.)
149. (1568) *Nycticorax griseus.*—(THE NIGHT HERON.)
150. (1572) *Ardetta cinnamomea.*—(THE CHESTNUT BITTERN.)
151. (1584) *Sarcidiornis melanonotus.*—(THE NUKTA or COMB-DUCK.)
152. (1589) *Dendrocycna javanica.*—(THE LESSER WHISTLING-TEAL.)
153. (1617) *Podicipes albipennis.*—(THE INDIAN LITTLE GREBE.)

PLATE A.



BREEDING GROUNDS OF THE BARRED-HEADED GOOSE

(*ANSER INDICUS*).

THE NESTING OF THE BAR-HEADED GOOSE (*ANSER INDICUS*) IN TIBET.

BY

F. M. BAILEY.

(*With Plate A.*)

On the 2nd June 1908 on my way down from Gyantse to Phari, I left the main road which skirts the Northern shore of the Hram-tso—a lake 14,700 feet above sea level and some eight miles long by four broad—and travelled round the Southern side, halting for two days at the village of Hram. The Southern shore of this lake is bordered by a belt of marsh about 2 miles broad in its widest parts. On this marsh thousands of bar-headed geese breed, and it was the hope of being able to visit their nests that brought me here. The villagers of Hram annually collect hundreds of these eggs and sell them at the rate of 30 for a rupee to men who carry them to different parts of Tibet for sale. This year, however, for religious reasons the killing of all game and the taking of the eggs of wild birds has been prohibited by the Lhasa Government, and so I was fortunate in finding the birds more or less undisturbed. On arriving at the village I sent for some men who could show me where the nests were and we walked the mile between the village and the edge of the lake, carrying with us a flat-bottomed Tibetan skin boat. This we launched at the edge of the lake and I was pushed across a few hundred yards of clear water which was only about 2 feet deep. Here we were on the marsh and could see dry islands ahead of us, white with thousands of geese. The nearest of these islands was only about a quarter of a mile away, but we were at least a quarter of an hour covering this distance. Every step one sank in up to the thighs in mud and at that elevation frequent rests were necessary. I was told that we were having luck in crossing the marsh as if the wind had been blowing from the North, that is from the deeper part of the lake towards the marsh, the water would have been banked up on the marsh and it would have been too deep to be passable. As we neared the first island my guides pointed out the tracks of men over the marsh who they told me must have come by night, disobeying the orders from

Lhasa regarding the taking of eggs this year; but I suspect that my guides themselves had taken a few eggs for their own consumption, as a stranger would be sure to get lost, the marsh being impassable in many places. At last we reached the first nests. They were situated on a grassy island about 2 feet higher than the marsh. This island was circular and about 20 yards in diameter and contained fifteen nests. The nest consists of a slight hollow in the grass plentifully lined with down which is banked up round it. The nests contain from 2 to 8 eggs, the commonest number being four, and the number of birds in the broods that are seen all along the roadside on the Northern shore of the lake is almost invariably four. I am inclined to think that when there are more than four eggs in a nest, some are bad ones which were laid possibly by another bird, as some of the eggs in a nest containing more than four eggs are always very discoloured and evidently much older than others and might perhaps have been laid the previous year. I noticed this in one case in which birds were just being hatched from the fresher looking eggs. These birds seem to lay their eggs in a very promiscuous manner for I saw many single eggs laid on the grass outside the nests. The Tibetan collectors only take quite fresh eggs which can at once be known by their clean appearance as the eggs become soiled with mud from the sitting parent very soon after they are laid. As soon as the eggs are hatched the birds leave the marsh and move across to the open water and are seen in great numbers on the northern shore of the lake; and except the very freshly hatched birds I saw no young ones on the marsh. This lake is frozen over in winter but at the beginning of March, as soon as some clear pools are melted, a few geese and duck may be seen and birds remain there until the lake freezes in November. A young bird shot in the beginning of winter has no bars on the head. The broad black line which in an old bird runs down the back of the neck below the bars is continued on to the forehead, but is not quite so dark on the young bird as it is on the old one. Apparently the only protection which the birds have is the impassability of the ground between their nests and the shore, as no attempt at concealment of the nests is made. I saw a number of eagles on the marsh, but I think most of them were fish eagles.

The Tibetan name for the bar-headed goose is "Angba Karpo" or more briefly "Ang Kar" which means "white goose." The Brahminy duck which nests in ruined houses and rocks near the lake is called the "yellow goose." I made careful enquiries from the egg collectors as to the presence of any other kind of goose on the lake and they assured me that the bar-headed goose was the only kind and I have never seen any other species at any time of the year.

After taking as many eggs as I wanted I returned, but sent some men on to see if they could get the eggs of *Grusnigricollis* of which many were feeding on the marsh, and in the evening they brought me one egg and a clutch of terns eggs. The brown-headed gull (*Larus brunneicephalus*) was also seen in large numbers and one egg was brought to me subsequently.

The photographs show the individual nests, which appear as white patches, and also the down scattered all over the nesting ground. They also show how the nests are crowded together, the distance between them being frequently less than a yard.

PLANTS OF THE PUNJAB.

A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR.

BY

Lieut.-Colonel C. J. Bamber, F.L.S.,

Indian Medical Service.

Part III.

(Continued from page 86, of this Volume).

Erect Shrubs.

Shrubs with Opposite Stipulate Simple Leaves.

Petals Ununited.

Bergia odorata, Elatineæ. F. B. I. i. 251, The Plains.	small, one foot or less high, widely spreading glandular hairy, bark papery peeling ; leaves 1/12-⅓ in. sessile, thick, ovate, margins minutely toothed, often reflexed ; flowers ⅙ in. long on bare branches in bunches, sepals and petals 5, stamens 10, styles 5 ; capsule 5-celled, seeds many, minute, curved.
Bergia æstivosa, Elatineæ. F. B. I. i. 251. The Plains. Multan.	small, much like the last, but not glandular hairy, much branched, branches slender, widely diverging, flowers solitary or 2-4 together, pink, sepals lanceolate with membranous margins.
Euonymus Hamiltonianus, *Siki, singi, naga.* F. B. I. i. 612 Himalaya, 5-6,000 feet.	large, bark thick corky ashy grey ; leaves dull green, 2-6 by ¾-1½ in., oblong, long pointed, finely toothed, smooth, thin ; leaf stalk ½ inch long ; stipules fringed, soon falling off ; flowers in short clusters, ⅓ in. diam., greenish white, sepals 4-5, petals 4-5, margin rolled under, stamens 4-5, styles short ; capsule ⅕-⅓ in. long, top shaped, deeply 3-4 lobed, yellow when ripe, seeds one to two in each cell, enclosed in a red fleshy coat.
Sageretia oppositifola,	see Climbing Shrubs, Opposite, Stipulate, Simple.

SHRUBS WITH OPPOSITE STIPULATE SIMPLE LEAVES.

PETALS UNITED.

Hymenodictyon excelsum,
Kukuhar.
RUBIACEÆ.
F. B. I iii. 35.
Himalaya. East of the Ravi river, to 2,500 feet.

large, bark soft, brownish grey, smooth on branches, corky and furrowed on old stems ; leaves 4-10 by 3-5 in., uneven sided, oblong, obtuse or long pointed, membranous, velvety on both surfaces, narrowed into a stalk 1-3 ins. long, stipules soon falling off, oblong, broad based, recurved ; flowers $\frac{1}{5}$ in. long, white, fragrant, in large spreading branching racemes with bracteate spicate branches, bracts large leafy, persistent, calyx $\frac{1}{12}$ in., soon falling off, lobes 5-6, corolla $\frac{1}{5}$ in. long, funnel shaped, lobes 5, short, sharp, stamens 5 ; capsule $\frac{1}{2}$-$\frac{3}{4}$ in. long on short recurved stalks, oblong with rounded ends, 2-valved, many seeded, seeds flat, double convex, winged all round the margin, $\frac{3}{10}$ by $\frac{1}{10}$ in. with the wing. The inner bark is used by Hindus as a cure for ague, this shrub is closely allied to Cinchona.

Randia tetrasperma,
Kikra.
RUBIACEÆ.
F. B. I. iii. 109.
Salt range,
Himalaya, 4-6,000 ft.
Simla (Collett).

small, branches rough grey rigid, often spinous : leaves at the tips of branchlets, $\frac{1}{2}$ 2 in. long, tapering at both ends or broad at the apex, narrowed into a short stalk, smooth ; stipules small, triangular tapering to a point ; flowers nearly solitary, sessile greenish-white, fragrant, $\frac{1}{4}$ in. diam., calyx hairy lobes 5, large, narrow, corolla tube $\frac{1}{3}$ in. long, hairy outside, lobes 5, stamens 5 ; berry $\frac{1}{4}$ in. diam., round, 4-seeded, purple.

Randia dumetorum,
Mainphal.
RUBIACEÆ.
F. B. I. iii, 110.
Himalaya, to 3,000 ft,

large, bark grey, spines horizontal, often long and stout ; leaves 1-2 ins long with the broad end towards the apex ; narrowed into a short marginate stalk, stipules ovate, long pointed ; flowers hairy, yellowish white, fragrant, solitary or 2-3 together at the end of short lateral branchlets, calyx bell-shaped, hairy, lobes ovate, corolla lobes 5, spreading, oval or oblong ; berry soft fleshy, 1-1$\frac{1}{2}$ in. long, ovoid, yellow, smooth or velvety, skin leathery, thick, edible ; seeds many, flattened, in gelatinous pulp.

SHRUBS WITH OPPOSITE STIPULATE SIMPLE LEAVES

PETALS UNITED.

Ixora coccinea, **The Flame Tree.** *Rungan.* RUBIACEÆ. F. B. I. iii. 145. The Plains.	medium size, branches stiff, rather stout; leaves 2-4 by 1-2 ins., sessile, leathery, shortly oblong; stipules with stiff long points; flowers scarlet, in dense short stalked bunches, calyx tube 4-toothed, persistent, corolla tube, 1-$1\frac{3}{4}$ ins., lobes broad, pointed, four, stamens 4, short, styles 2 branched; fruit sometimes fleshy $\frac{1}{4}$ in. diam., crowned by the calyx; seeds concave. The root is used in native medicine as a cure for dysentery.
Hamiltonia suavolens *Padena, kanera.* RUBIACEÆ. F. B. I. iii. 197. Salt range, Himalaya, 2-5,000 ft. Valleys below Simla (Collett). Dharmpur (Bomford).	small, branches in threes, fetid when bruised; leaves 3-9 ins., long by 2-$3\frac{1}{2}$ ins., rather rigid, stalked, leathery, smooth, often rough; stipules joined by their margins, short, short pointed, persistent; flowers sessile or shortly stalked, sweet scented, till crushed, crowded in large three branching racemes, blue or white, calyx lobes 5, persistent, corolla tube $\frac{1}{4}$ in. long, woolly, lobes short, pointed, spreading, stamens 5; capsules oblong with round ends, $\frac{1}{10}$ in. long, 1-celled. 5-seeded; seeds sharply three cornered.
Leptodermis lanceolata, RUBIACEÆ. F. B. I. iii. 198. Himalaya, 4-10,000 ft. Simla (Collett). Dharmpur (Bomford).	small, bark thin, grey; leaves and young shoots fetid when crushed; leaves 1-3 in., shortly stalked, narrowed at both ends, finely pointed, both surfaces covered with minute white hairs; stipules short, broad, pointed, persistent; flowers $\frac{1}{2}$ in. long, white or purplish, in small bracteate heads at the end of short branches forming a large branching raceme, each flower half enclosed in a tube of two pointed partially united, thin bracts, calyx 5-lobed, small, fringed, persistent, corolla funnel-shaped, lobes 5, short, spreading, stamens 5, short, style long, 5-branched; capsule cylindric, $\frac{1}{3}$ in. splitting into 5 valves; seeds 5 each in a loose covering.
Leptodermis virgata, RUBIACEÆ. F. B. I. iii. 198. Himalaya, 4-7,000 ft.	slender, rigid, very bushy, white velvety; leaves $\frac{1}{4}$-$\frac{1}{2}$ by $\frac{1}{12}$-$\frac{1}{8}$ in. linear, acute, margins flat or recurved, white beneath, stipules triangular with stiff long sharp recurved points, white; calyx smooth, hairy, corolla $\frac{1}{3}$ in. long, velvety, purplish, stamens 5, style as above; capsule $\frac{1}{8}$ in.; seeds with a few free fibres attached to the covering.

Shrubs with Opposite Stipulate Simple Leaves.

Petals United.

Gaillonia calycoptera,
Rubiaceæ.
F. B. I. iii. 201.
The Plains, Attock.

small, branches slender, stiff, erect, dividing in twos, lower white; leaves small linear in distant pairs, ½-1 in. long, margins rolled under, somewhat rough, stipules united with the leaf stalk into a sheath with teeth; flowers small, white in spikes, calyx 2-5 toothed, dilated after flowering into a thin feathery wing, corolla funnel-shaped, lobes 4-5, stamens 4-5, style thread like, arms 2, short; fruit ⅓ in. long of two narrowly oblong lobes, crowned with the enlarged calyx, seeds oblong, grooved.

Gaillonia hymenostephana,
Rubiaceæ.
F. B. I. iii. 202.
The Plains.
Waziristan, 3,500 ft.

very small, branches stiff, widely spreading, slender, very fetid when fresh; leaves ¼—½ in., linear, oblong, margins rolled under; stipules rudimentary except of floral leaves, which are joined and 2 lobed; flowers solitary or in small clusters at the end of branchlets; like the last as to calyx, corolla, etc.; fruit of two hairy lobes crowned with a large orbicular horizontal five lobed wing.

Petals None.

Ficus hispida,
Gobla, Daduri.
Urticaceæ.
F. B. I. v. 522.
The Plains to 3,500 ft.

medium size, bark thin, grey, smooth, warty on old stems, often with transverse wrinkles; branches hollow; leaves 4-12 in. long, ovate, short pointed, toothed, leathery, rough above, woolly beneath, leaf stalk ½-4 in. long, stipules ½ in. long, velvety; fruit is a fig, top-shaped, 1 in. long, hairy, yellowish and faintly ribbed when ripe, usually clustered on leafless branchlets from the old wood, or on young plants, in pairs on leafy branches. The bark is used in native medicine as an emetic.

Bæhmeria platyphylla,
F. B. I. v. 578.
Urticaceæ.
Himalayas, to 5,000 ft.
Valleys below Simla (Collett).

large, branches rough, dark brown, four-sided: leaves usually opposite, stalked, broadly ovate or orbicular, 4-9 by 3-7 in., long pointed, toothed, stalk 1½-5 in., rough; flowers male and female, whitish on long branching drooping spikes, male calyx 3-5 fid, stamens 4-5, female calyx tubular, 2-4 toothed, style far protruding; fruit narrowed or beaked at the four toothed tip.

SHRUBS WITH OPPOSITE STIPULATE COMPOUND LEAVES.

Sambucus ebulus, **Dwarf Elder,** *Gandal.* CAPRIFOLIACEÆ. F. B. I. iii. 2. Kashmir, 6-10,000 ft.	small, leaves unequally pinnate, 9 in. long, leaflets 5-9, oblong. lanceolate, 3-6 in. long, slightly velvety; stipules often leafy; flowers with a strong odour in large many rayed level bracteate bunches, calyx 3-5 toothed, corolla $\frac{1}{6}$ in. dia., 3-5 lobed, broad, white, pink or dark purple; stamens 5, drupe $\frac{1}{6}$ in. dia., round, black when ripe, crowned with the calyx.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Berberis vulgaris, **Barberry,** *Chochar.* BERBERIDACEÆ. F. B. I. i. 109. Himalaya, 8-12,000 ft. Narkanda (Collett).	small, wood yellow, bark brown soft; leaves, in tufts in the axils of 3-5 forked spines, stalked, 1-3 in. long, margin spinous, toothed; flowers pale yellow in drooping racemes longer than the leaves, sepals 6, petal-like, in 2 series, petals 6, in 2 series stamens 6, style short; berry oblong, ovoid, red when ripe. This plant is used as a diuretic.
Berberis aristata, *Kashmal.* BERBERIDACEÆ. F. B. I. i. 110. Himalaya, 6-7,000 ft. Simla (Collett).	like the last species, young branches red tint, leaves sessile, broad, lanceolate, 1½-2 in. long, margin, with few teeth, racemes long stalked, branched, longer than the leaves. The root is used as a cure for ague in native medicine.
Berberis Lycium, *Chotra.* BERBERIDACEÆ. F. B. I. i. 110. Himalaya, 3-9,000 ft. Simla (Collett).	like the last, but smaller. bark white; leaves sessile, narrowly lanceolate, 1½ by ½ in., acute, margin smooth or only few small teeth, racemes shortly stalked, not branched, hardly longer than the leaves, berry ovoid violet, covered with bloom. Rasout, an extract from the root, is used as a febrifuge.
Cadaba farinosa, CAPPARIDACEÆ. F. B. I. i. 173. The Plains, Multan.	small, straggling, much branched, wiry, and hoary: leaves ¼-½ in., rarely 1 in. long, ovate, obtuse; flowers 1 in. diam., greenish-white, in few-flowered level bunches, petals 4, narrow, stalked oblong, stamens 4-6 on a long stalk; fruit ½-1½ in. long, fleshy, cylindric.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Gypsophila Stewartii, CARYOPHILLACEÆ. F. B. I. i. 216. Waziri Hills, 3-4,000 ft.	small, green, tufted, spinous ; leaves ¼ in., spreading, awl-like, flat above, convex beneath, points polished ; flowers pink in short stalked clusters, 8-15 flowered, calyx ovoid ⅙ in., 5 ribbed, teeth 5, slender, long, petals-5, narrow, 6 stamens 8-10, styles 2-3 ; capsule 4 valved.
Hypericum cernuum, **S. John' Wort.** *Pinli.* HYPERICACEÆ, F. B. I. i. 253 Himalaya, 5-7,000 feet. Simla (Collett).	medium size, branches cylindric, greenish, smooth, bluish when young ; leaves 1-3 in. sessile, oblong, minutely dotted. each pair at right angles to the next ; flowers in 3-5 flowered terminal clusters, 2 in. dia., white turning to yellow, sepals 5, ¼ in. long, ovate, petals 5, longer than the stamens, stamens many, joined below into 3 or 5 bundles, styles 5 ; capsule, ½ in., conical.
Hypericum lysimachioides. HYPERICACEÆ, F. B. I. i. 254. Himalaya, 5-8,000 ft. Simla, Mashobra, (Collett).	small, smooth, branches four-sided towards the ends ; leaves ovate, 1⅓ × ½ in., lower surface pale, black dotted ; flowers 1-1½ in. diam. in terminal leafy forked 2-3 flowered clusters ; sepals ⅓ in., lanceolate narrow, petals longer than the stamens, stamens in 5 bundles, styles 5, capsule ¼ in.
Hypericum patulum, HYPERICACEÆ F. B. I. i 254. Himalaya, 3-7,000 ft. Simla (Collett).	small, smooth, dark brownish, branches numerous, stiff, red, spreading two edged ; leaves ovate 1½ × ¾ in., each pair at right angles to the next, pale and black dotted beneath ; flowers 1 in. diam. in terminal few flowered clusters, sepals ovate, ¼ in., petals twice as long as the stamens, stamens in 5 bundles, styles 5, capsule ⅓ in.
Euonymus tingens,	see Trees. Opposite, Exstipulate, Simple.
Coriaria nepalensis, *Masuri,* CORIARIACEÆ. F. B. I. ii. 44. Himalaya, 3-7,000 ft. Simla (Collett).	large with long arching branches, bark red, rough, branchlets 4-angled ; leaves 1-3 by ¾-2 ins nearly sessile, ovate, shortly pointed ; racemes 2 6 ins., long, usually clustered, flowers small, ⅓ in. diam., greenish-yellow, sepals 5, persistent, petals 5, fleshy, persistent, keeled within, stamens 10, styles 5, fruit of 5-10,

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

flattened, one seeded nuts, ridged, surrounded by the enlarged purple petals, separating the nuts by their keels, seeds flattened.

Deutzia corymbosa,
SAXIFRAGACEÆ.
F. B. I. ii. 406.
Himalaya, 6-10,000 ft.
Mashobra, Shali, Narkanda (Collett).

medium size, stellately hairy, bark-thin, light brown, peeling in thin rolls, inner white ; leaves nearly sessile, 1½-3½ ins. by ¾-1½ ins. long pointed, ovate, with minute teeth, stellately velvet above, green below ; flowers white, fragrant, ½ in. diam. in terminal branching many—flowered clusters, calyx teeth 5, ovate, obtuse, petals 5, smooth stamens 10, winged forming 3 points, styles 3-5 ; capsule ⅕ in. diam., round, opening by 3-5 valves, seeds many minute.

Deutzia staminea,
SAXIFRAGACEÆ.
F. B. I. ii. 407.
Himalaya, 5-9,000 ft.
Simla, Prospect Hill (Collett).

medium size, stellately hairy, bark dark grey, peeling in long thin strips ; leaves 1-2½ ins. by ¼-1¼ ins., minute teeth, above stellately velvety, below grey with stellate wool ; flowers white, fragrant, ¾ in. diam., calyx 5, teeth triangular, petals 5, velvety outside ; stamens 10, winged, forming 3 points ; capsule smaller than the last.

Philadelphus Coronarius, Mock orange, or Seringat,
Dalunchi, buzru.
SAXIFRAGACEÆ,
F. B. I. ii. 407.
Himalaya, 5-9000 ft.
Matiana, Narkanda (Collett).

medium size, bark light grey ; leaves 1-½-4 by ¾-2½ ins., ovate-lanceolate, long pointed, finely hairy, glossy beneath, teeth minute, margin often hairy ; flowers white, orange scented, 1 in. diam. in short terminal racemes, sometimes solitary, calyx lobes 4, petals 4, rarely 5, stamens 20-40 not winged, styles 4, capsule ½ in. long, valves 4.

Osbeckia stellata,
MELASTOMACEÆ.
F. B. I. ii. 517.
Himalaya to 5,000 ft.
Lansdowne Falls, Simla (Collett).

medium size, branches four angled, bristly, leaves 3-6 ins. long, lanceolate, minutely bristly, tapering to a fine point ; nerves prominent, flowers purple, 2-2½ ins. diam., in small terminal clusters, calyxmatted white with starry bristles, lobes 4 or 5 large and 4 or 5 small, falling off after flowering, petals 4 or 5 twisted in bud, stamens 8-10, yellow, curved, capsule ½-¾ in. long, ovoid, covered with bristles, opening by pores, seeds many, minute.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Melastoma Malabathricum, Indian Rhododendron,
MELASTOMACEÆ.
F. B. I. ii. 523.
The Plains to 6,000 ft.

large, stems with short dense hairs; leaves 3-4 ins broad lanceolate, with hairs above and below; flowers 1-5, clustered, mauve-purple, calyx tube with simple hairs, lobes 5, long, soon falling off, petals 5, stamens 10, anthers alternately purple with a long curved process above; fruit $\frac{1}{4}$ in. wide, short, ovoid, abruptly ended, becoming pulpy within; seeds many, minute, curved. A purple dye is made from the fruit.

Woodfordia floribunda,
Dhan, Dhanla.
LYTHRACEÆ.
F. B. I. ii. 572.
The Plains to 5,000 ft.

large, long arching branches, bark reddish-brown, peeling in fibres; young branches and leaves with numerous black dots; leaves sometimes in threes, sessile, lanceolate, 2-4 ins. tapering to a fine point, upper surface green, lower white, velvety with black dots; flowers in shortly stalked clusters on and around branches, bright red; calyx, red, 6 teeth, petals 6, red, scarcely longer than calyx teeth; stamens red, long protruding; capsule $\frac{3}{8}$ in., enclosed in the calyx. The flowers are used as a dye and as an astringent, containing much tannin.

Lawsonia alba, Henna, Camphire
Mehndi.
LYTHRACEÆ.
F. B. I. ii. 573.
The Plains to 5,000 ft.

medium size, bark thin, greyish brown; branchlets angular sometimes spinous; leaves $\frac{3}{4}$-1 in. long, oblong, acute at both ends or the tip obtuse, margin smooth, leathery; flowers greenish white, $\frac{1}{5}$ in. in large terminal branching racemes, sweet scented, sepals 4, petals 4, wrinkled stamens 8, inserted in pairs between the petals; capsule $\frac{1}{5}$ in. diam., round with persistent calyx, leathery; seeds many, smooth, angular, pyramidal. The leaves are used to dye the hands, feet and hair red.

Lagerstræmia indica, China crape,
Saoni, dhaura.
LYTHRACEÆ.
F. B. I. ii. 575.
The Plains.

medium size, bark light brown, very smooth, peeling in dark coloured scurfy pieces; leaves upper alternate 2 ins. long, smooth, oblong, sessile, short pointed: flowers 1½-2 ins. diam., bright pink or white in branching racemes, calyx tube smooth, teeth 6 or 7-9, petals $\frac{1}{2}$-$\frac{3}{4}$ in. long, 6 or 7-9, stalked, much curled, stamens many, long; capsule $\frac{1}{3}$ in. diam., nearly round, calyx long triangular, erect on the capsule seed; $\frac{1}{4}$ in. with wing.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Punica Granatum, **Pomegranate,** *Anar.* LYTHRACEÆ. F. B. I. ii. 580. The Plains to 5,000 ft.	large, bark dark grey, branchlets often spinous, leaves sometimes hardly opposite or clustered, 1-2$\frac{1}{2}$ ins. long, oblong, obtuse, narrowed to a short stalk with a margin, smooth, shining ; flowers vivid red, sessile, solitary or 3 together, calyx greenish red, 1 by $\frac{1}{2}$ in., tubular, fleshy, with 5-7 points; petals 5-7, $\frac{1}{2}$-1 in. long, thin, wrinkled, bright red, stamens many ; fruit 1$\frac{1}{2}$-3$\frac{1}{2}$ ins. diam., round, with a thick reddish brown leathery rind, crowned by the calyx ; seeds $\frac{1}{5}$ in. long, angled in ruby red flesh with sweetish astringent juice. The bark is used as a tan and dye, and as a vermifuge.
Cornus sanguinea, **The Cornel or** **Dogwood Tree.** CORNACEÆ. F. B. I. ii 744. Kashmir, 7,000 ft. Gulmerg.	medium size ; branchlets, leaves beneath, and bunches of flowers with minute white hairs; young shoots are red ; leaves 1$\frac{1}{2}$ to 3 ins. long, smooth margin, ovate, turn red in the autumn : flowers small in branching bunches, sepals, petals and stamens in fours; drupe ovoid $\frac{1}{5}$ in. diam., minutely hairy, 2-celled, 2-seeded ; seeds oblong, flattened.

PETALS UNITED.

Viburnum cotinifolium, *Banguch.* CAPRIFOLIACEÆ. F. B. I. iii. 3. Himalaya, 6-11,000 ft. Simla (Collett).	medium size, bark grey ; leaves 3-3$\frac{1}{2}$ ins. long, nearly orbicular, stellately woolly beneath ; flowers in dense clusters, which are 3-4 ins. across, calyx 5-toothed, smooth, corolla tube $\frac{1}{5}$ in. long, funnel-shaped, white tinged with pink, stamens 5, style short ; drupe $\frac{1}{3}$ in. long, oblong, compressed, ribbed, red, black when ripe, edible ; seed dorsally two-grooved.
Viburnum stellulatum, *Richi, Ensi.* CAPRIFOLIACEÆ. F. B. I. iii. 4. Himalaya, 6-11.000 ft. Simla, Mahasu (Collett).	large, branches long, bark almost black ; leaves 3-4 by 1$\frac{1}{2}$-2 ins., ovate, long pointed distantly sharp toothed, stellate hairs beneath : flowers small very many in large level topped terminal bunches, calyx 5-toothed, stellately hairy, corolla white, velvety, 5-lobed, stamens 5 ; drupe $\frac{1}{4}$ by $\frac{1}{5}$ in., compressed, broadly oblong, yellow, red, edible ; seed 2-grooved on both surfaces.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Viburnum coriaceum, CAPRIFOLIACEÆ. F. B. I. iii. 5 Himalaya, 4-8,000 ft. Simla (Collett).	large, bark grey : leaves 4-9 by 1½-2½ ins. oblong, long pointed, very leathery, smooth, stalk 10 ins. long: flowers ¼ in long, many in terminal flat-topped bunches, calyx smooth, no teeth, corolla white, tubular, lobes erect, stamen tops red ; drupe black, ovoid, ⅕ in.
Viburnum nervosum, *Amrola, thal-in.* CAPRIFOLIACEÆ. F. B. I iii. 8. Himalaya, 10-13,000 ft.	large, branches stout, bark grey ; leaves 2½-3½ by 1¼-1½ in., oblong, sides unequal, short pointed, minutely toothed, nerves prominent ; flowers in compact silky branching racemes, pinkish, calyx smooth, teeth small, corolla tube ¼-⅓ in., drupe ⅓ by ¼ in. oblong with rounded ends, edible.
Viburnum fætens, *Guch.* CAPRIFOLIACEÆ. F. B. I. ii. 8. Kashmir, 6-10,000 ft. Muree to Chamba, Narkanda (Collett).	large, very much like the last, but leaves 4 in. long toothed emitting an unpleasant asafœtida-like smell on being crushed ; flowers sweet-scented, corolla tube ½-¾ in. long, pink, stamens 2 near the top of tube, 3 below ; drupe ½ in. long, red, edible.
Abelia triflora, *Binbakhara.* CAPRIFOLIACEÆ. F. B. I iii. 9. Himalaya, 5-10,000 ft. Naldera (Collett).	medium size, bark grey ; branches long, grooved : branchlets slender, often drooping ; leaves 2-3 by ¾-1¼ in., minutely fringed long pointed, stalks short dilated at the base ; flowers scented, white or pinkish, ¾ in. long, in small bracteate 3 flowered clusters, middle flower sessile, crowded, terminal, calyx hairy 5 ribbed, teeth 5, long fringed, persistent, corolla funnel shaped, lobes 5, short, round, stamens 4 ; fruit dry, oblong, crowned with the calyx lobes, 3-celled, one-seeded.
Lonicera hispida, CAPRIFOLIACEÆ. F. B. I iii. 11. Himalaya, 9-13,000 ft. Marali (Collett).	medium size, leaves hairy, nearly sessile, acute, 1-4 in. long, ovate ; flowers ¾ in. long, each pair on a single stalk in the axil of a leaf, bracts hairy, ½ in. long, boat-shaped, half concealing the flowers, bracteoles none, calyx ovoid, teeth uneven, corolla ¼-½ by ⅙ in., green, lobes 5, pink, nearly regular, tubular, not two-lipped, stamens 5 ; berries red, ovoid ⅓ in., distinct or united, seeds few.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Lonicera glauca, *Shintik, shewa.* CAPRIFOLIACEÆ. F. B. I. iii. 11. Kashmir, Himalaya, 12-16,000 ft.	small, wiry, under shrub, growing in fissures of rocks, densely branched, smooth except as to margins of leaves; leaves $\frac{2}{3}$ by $\frac{1}{4}$ in., obtuse; bracts bluish green, hairy on margin, usually ununited, $\frac{1}{4}$-$\frac{1}{3}$ in. ovate, calyx nearly smooth, corolla-tube $\frac{1}{4}$-$\frac{1}{2}$ by $\frac{1}{2}$ in. smooth, lobes yellow, regular not two-lipped, stamens 5. berries $\frac{1}{4}$ by $\frac{1}{5}$ in., sometimes united.
Lonicera asperifolia, CAPRIFOLIACEÆ. F. B. I. iii 11. Kashmir, 12,000 ft.	small, sparsely hairy; leaves $1\frac{1}{4}$ by $\frac{3}{4}$ in., ovate oblong, margin crisped and hairy, shining and smooth above, bracts $\frac{1}{3}$ in. ununited, ovate, corolla tube $\frac{1}{2}$ by $\frac{1}{8}$ in., slightly hairy, lobes $\frac{1}{4}$ in.; berry $\frac{1}{3}$ by $\frac{1}{4}$ in. crowned by the funnel shaped calyx.
Lonicera purpurascens, CAPRIFOLIACEÆ. F. B. I. iii. 12. Himalaya, 9-12,000 ft. Hattu (Collett).	small; bark peeling off in thin shreds; branches dark grey; leaves $1\frac{1}{2}$ by $\frac{1}{2}$ in., shortly stalked, hairy, oblong, lower surface woolly; flowers $\frac{1}{2}$ in. long, each pair on one stalk in the axil of a leaf; bracts linear $\frac{1}{4}$ in. spreading, bracteoles short; corolla purple, tubular, not two-lipped, hairy; berries two joined into one, $\frac{1}{4}$ in. diam., black, round.
Lonicera angustifolia, *Jinjru, philku.* CAPRIFOLIACEÆ. F. B. I. iii. 13. Himalaya, 6-12,000 ft. Simla (Collett).	small; bark smooth grey peeling in long papery flakes; leaves 1-$2\frac{1}{2}$ by $\frac{1}{4}$-$\frac{3}{4}$ in., shortly stalked, lanceolate, lower surface pale; flowers $\frac{1}{3}$-$\frac{1}{2}$ in. long each pair on a single stalk in the axil of a leaf; bracts linear or leafy, $\frac{1}{3}$ in. spreading, bracteoles united enclosing the fruit, corolla tubular, not two-lipped, white tinged with pink, velvety, scented; berries two, joining to form one, round, red, $\frac{1}{4}$ in. dia.
Lonicera spinosa, CAPRIFOLIACEÆ. F. B. I. iii. 13. Himalaya, 11-16,000 ft.	small, branchlets bluish green, often leafless and spinous; leaves $\frac{1}{2}$ in. by $\frac{1}{8}$-$\frac{1}{6}$ in., obtuse, margins recurved, stalk hardly any, narrow oblong; flowers almost sessile, bracts $\frac{1}{5}$ in. linear, bracteoles quadrate. united, corolla tube $\frac{1}{3}$-$\frac{1}{2}$ by $\frac{1}{12}$-$\frac{1}{8}$ in., smooth, not two-lipped, berries $\frac{1}{5}$ by $\frac{1}{6}$ in. not joined, crowned by the calyx.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Lonicera parvifolia, CAPRIFOLIACEÆ. F. B. I. iii. 13. Himalaya, 8-12,000 ft. Simla, Jaku, Hattu, the Chor (Collett).	small, branches often prostrate; leaves $\frac{1}{3}$-$\frac{1}{2}$ in. shortly stalked, obtuse, lower surface pale; flowers $\frac{1}{3}$-$\frac{1}{2}$ in. long, each pair on one stalk in the axil of a leaf, bracts narrow, long, bracteoles united, corolla not two-lipped, tubular white tinged with pink; berries two-joined into one, red, round, $\frac{1}{4}$ in. diam.
Lonicera obovata, CAPRIFOLIACEÆ. F. B. I. iii. 14. Himalaya, 8-13 000 ft.	small; leaves small obovate, $\frac{1}{2}$ by $\frac{1}{4}$-$\frac{1}{3}$ in., obtuse nearly sessile; flowers very small, tubular, funnel-shaped, not two-lipped, slight spur, yellowish white often in fours, two on one stalk; berries united, two calyx sears on top, roundish, $\frac{1}{5}$ in. diam.
Lonicera quinquelocularis, **Himalayan Honeysuckle,** *Bakru, phut.* CARPIFOLIACEÆ. F. B. I. iii. 14. Hymalaya, 4-12,000 ft. Simla, (Collett).	large; bark grey with vertical furrows exfoliating in long strips; branchlets velvety; leaves $1\frac{1}{2}$-2 by $\frac{3}{4}$-$1\frac{1}{2}$ in., ovate, smooth above, woolly beneath; flowers two-lipped, white turning yellow, $\frac{1}{2}$-$\frac{3}{4}$ in. long, a pair or clustered in threes or fours in the axil of a leaf; bracts linear, short; bracteoles united below into a cup; berries distinct, $\frac{1}{4}$ in. long, ovoid, white.
Lonicera microphylla, CAPRIFOLIACEÆ. F. B. I. iii. 15. Kashmir, 11-14,000 ft.	small, branchlets smooth; leaves almost sessile, $\frac{1}{2}$-$\frac{3}{4}$ by $\frac{1}{4}$-$\frac{1}{3}$ in., obtuse, velvety beneath; flowers whitish yellow, two-lipped, corolla tube $\frac{1}{5}$ by $\frac{1}{8}$ in., pouch like swelling at the base, bracts $\frac{1}{8}$-$\frac{1}{6}$ in. linear, bracteoles none; berries $\frac{1}{6}$ in., oblong with rounded ends united at the lower portion.
Lonicera orientalis, CAPRIFOLIACEÆ. F. B. I. iii. 15. Himalaya, 7-11,000 ft. Narkanda (Collett).	large; bark peeling in long strips, branches, horizontal, flattened; leaves 2-4 by $1\frac{1}{2}$-$2\frac{1}{2}$ in., ovate, velvety, and dotted beneath; flowers pink, $\frac{1}{2}$ in. long, each pair on a single stalk in the axil of a leaf, two-lipped, corolla tube $\frac{1}{8}$ in., pouch-like swelling at the base, bracts linear, bracteoles small, rounded or large or none; berries united in pairs, black, round, $\frac{1}{4}$ in. diam.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Lonicera heterophylla, CAPRIFOLIACEÆ. F. B. I. iii. 15. Kashmir, Himalaya, 12,000 ft.	branches smooth, rigid, ascending ; leaves 2½ in. by ½-1 in., narrow, oblong, smooth ; flowers like L. orientalis ; berries ⅕ by ⅙ in., not united.
Lonicera alpigena, CAPRIFOLIACEÆ. F. B. I. iii. 15. Himalaya, 9-12,000 ft. Hattu (Collett).	bark grey brown, peeling in flakes, branchlets, velvety ; leaves 3-4 by 1-2 in., oblong, long pointed, smooth above, velvety beneath ; flowers ¾ in. long, each pair on a single stalk in the axil of a leaf, bracts linear, long ; bracteoles very small, corolla two-lipped, hairy, yellow turning to red, pouch-like below ; berries ununited, red, round, ¼ in. diam.
Leycesteria formosa, CAPRIFOLIACEÆ. F. B. I. iii. 16. Himalaya, 5-10,000 ft. Simla, Mahasu (Collett).	small, herbaceous, smooth, bark grey, stem and branches hollow ; leaves 2-5 by 1-3 in., ovate sometimes toothed, long pointed, stalks united at the base ; flowers in spikes, arranged in circles, white tinged with purple, 1 in. long, bracts leaf-like, tinged with purple, bracteoles like the bracts but smaller, corolla funnel-shaped, 5-lobed, stamens 5; berry hairy, dark purple, round, ¼ in. diam., crowned by the calyx, seeds minute, many.
Eupatorium Reevesii, COMPOSITÆ. F. B. I. iii. 243. Himalaya, 2-6,000 ft. Valleys below Simla (Collett).	medium size, grey velvety, stems much branched, leaves shortly stalked, 3 by ½ in., ovate, toothed, upper smaller and sometimes alternate ; flowers pale purple in heads arranged in large spreading branching racemes bracts round the heads, heads ¼ in. long flowers all tubular, lobes 5, short, inner blunt, with a ring of fine rigid rough hairs (pappus) at the base : seeds ⅛ in. angled, crowned by the fine hairs.
Eupatorium cannabinum, **Hemp Agrimony,** COMPOSITÆ. F. B. I. iii. 243. Himalaya, 3-11,000 ft.	medium size, velvety ; leaves sessile in pairs, sometimes in circles, 4 by 1½ in., lanceolate, toothed , flowers whitish in heads, ⅓ in. long, arranged in compact rounded clusters, inner bracts sharp , flowers all tubular with pappus as the last.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Nyctanthes Arbor-tristis.
Harsingar.
OLEACEÆ.
F. B. I. iii. 603.
The Plains, Valleys below Simla (Collett).

large, rough hairy; branches four-angled; leaves ovate, 3-4 in., rough; flowers sessile, in clusters of three to seven forming branching racemes, fragrant, bracts 2, ovate; calyx $\frac{1}{5}$ in., corolla summit flat circular, lobes 6, divided into two, margin jagged, white, tube, $\frac{1}{4}$ in. long, cylindric, bright orange, stamens 2, very short; capsule flat, circular, $\frac{1}{2}$-$\frac{3}{4}$ in. diam. splitting into two. The flowers are used as a dye. The plant is considered by the Hindus to be sacred.

Syringa persica,
Persian Lilac,
OLEACEÆ.
F. B. I. iii. 604.
West Kashmir, 8,000 ft.

smooth; leaves 1 in., acute, lanceolate, smooth, sometimes pinnatifid or pinnate; flowers in terminal compound racemes, scented, corolla lilac or white summit flat circular, lobes 4, tube $\frac{1}{4}$ in. stamens 2; capsule $\frac{1}{3}$-$\frac{1}{2}$ in. by $\frac{1}{8}$ in., cylindrical, 4-ribbed, seeds winged.

Syringa Emodi,
Banphant, lolti.
OLEACEÆ.
F. B. I. iii. 605.
Himalaya, 9-12,000 ft.
Narkanda, Baghi (Collett).

large, young parts velvety; leaves $2\frac{1}{2}$-5 by 1-2 ins., ovate, acute, smooth, pale beneath; flowers in terminal branching racemes densely flowered, small, white, scented, corolla summit circular, lobes 4 long pointed, tips turned in, tube $\frac{3}{10}$ in. cylindric, stamens 2; capsule cylindric $\frac{3}{4}$ in. long, seeds flat winged.

Ligustrum compactum,
OLEACEÆ.
F. B. I. iii. 616.
Himalaya, 5,000 ft. Valleys below Simla. Koti, Khogna (Collett).

large, smooth, bark grey, branches sometimes dotted with small corky excrescences; leaves lanceolate uneven sided, 3-5 by 1-2 ins., leathery, shining above: flowers small, white, nearly sessile in large terminal branching racemes 4-6 ins. long, corolla funnel shaped, lobes 4, stamens 2; fruit many, [illegible] long, cylindric, often curved.

Salvadora persica,
The Toothbrush Tree.
Khaindu, kaurijal.
SALVADORACEÆ.
F. B. I. iii. 619.
The Plains.

large, smooth; leaves ovate, $1\frac{3}{4}$-$2\frac{3}{4}$ ins., blunt, fleshy; flowers, greenish white in branching racemes, longer than the leaves, scattered, minute, calyx $\frac{1}{20}$ in., corolla $\frac{1}{10}$ in., tube with sometimes 4 small teeth within at the base, lobes 4, reflexed, stamens 4; drupe $\frac{1}{8}$ in. diameter, round, on the persistent calyx and corolla, pink, translucent, edible. Royle considers this to be the Mustard tree of the Bible, the bark is acrid and used as a native medicine.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Salvadora oleoides, *Jal, Peelu.* SALVADORACEÆ. F. B. I. iii. 620. The Plains.	large, smooth, leaves narrow, grey green, 2 by $\frac{1}{3}$ in.; flowers like the last, but the racemes consist of axillary clusters of short spikes, shorter than the leaves, stalks rough from the crowded scars of the flowers that have dropped; drupes clustered $\frac{1}{6}$ in. nearly sessile, yellow when ripe, sweet, much eaten, reddish brown when dried, and taste like currants.
Carissa carandas, *Karaunda.* APOCYNACEÆ, F. B. I. iii. 631. The Plains to 5,000 ft.	large, spinous; branches forking, rigid; thorns two, simple or forked, at axils or nodes, 1-2 ins. long; everywhere smooth except flower clusters; leaves $1\frac{1}{2}$-3 ins. long, broadly ovate, leathery, shining above, tip rounded or obtuse; flowers white, scented, crowded in terminal clusters; calyx teeth 5, corolla tube $\frac{1}{2}$-$\frac{3}{4}$ in., cylindric below, dilated above, lobes acute, about half as long as the tube; velvety; berry ovoid, $\frac{1}{2}$ inch long, red then black, polished, edible, four or more seeded. It is used as an antiscorbutic also in curries and chutney.
Carissa spinarum, APOCYNACEÆ. F. B. I. iii. 631. The Plains to 6,000 ft.	small, bark light grey, branches forked; like the last, but with smaller acute leaves and a smaller two seeded berry.
Tabernæmontana coronaria, *Chandui.* APOCYNACEÆ. F. B. I. iii. 646. The Plains.	large, smooth, bark silver grey, branches forking; leaves 4-6 by 1-$1\frac{1}{2}$ ins. shining above, rather leathery, pale beneath, margins waved; flowers 1-$1\frac{1}{2}$ ins. diam., pure white, fragrant, often double, calyx persistent, lobes 5, corolla tube $\frac{3}{4}$-1 in. long, slightly inflated in the middle, mouth glandular, lobes obtuse, margins overlapping to the left, curled, stamens 5, short; follicles 1-3 ins., cylindrical somewhat fleshy, spreading recurved, 3-ribbed; seeds 3-6, oblong, striated, with a red fleshy covering.
Nerium odorum,	see Shrubs, Alternate, Exstipulate, Simple.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Periploca aphylla, *Bata.* ASCLEPIADACEÆ. F. B. I. iv. 13. The Plains. The Salt range.	branches as thick as a goose quill or less, smooth or tips velvety, sometimes leafless; leaves $\frac{1}{6}$-$\frac{1}{4}$ in. linear, thick; flowers purple in opposite clusters, branches of common stalk, short, thick, sepals 5, broad, corolla $\frac{1}{2}$-$\frac{2}{3}$ in. diam., smooth externally, lobes ovate, densely bearded above the middle internally, coronal scales within corolla, fragrant, edible, tastes like raisins, stamens in a column with 5 tips; follicles $\frac{3}{4}$ by $\frac{1}{2}$ in., woody, cylindrical, rigid; seeds $\frac{1}{4}$ in. oblong with a tuft of hairs 1 in. long.
Calotropis gigantea, *Mudar, Ak.* ASCLEPIADACEÆ. F. B. I. iv. 17. The Plains to 3,000 ft.	large, bark pale, juice milky, acrid, young parts white woolly; leaves 4-8 by 1-3 ins., sessile ovate, smooth whitish green above, cottony beneath; flowers in loose racemes or solitary, $\frac{3}{4}$-2 ins. diam., pink with purple spots, calyx lobes 5, corolla lobes 4, spreading, coronal scales 5 within corolla, truncate hairy, stamens joined into a column with 5 tips; follicle recurved, 3-4 ins. long, thick, wrinkled covered with white wool; seeds $\frac{1}{4}$ inch broadly ovate with a tuft of hairs. The milky juice forms a kind of Guttapercha; the root bark is an emetic and cure for dysentery.
Calotropis procera, *Mudar, Ak.* ASCLEPIADACEÆ. F. B. I. iv. 18. The Plains to 3,500 ft.	like the last, but smaller, leaves larger, more oblong, acute, flowers scented, corolla lobes erect, coronal, scales acute, smooth or only velvety, follicles 4-5 ins., seeds ovoid.
Cynanchum Vincetoxicum,	see Herbs, Opposite, Exstipulate, Simple, Entire.
Cynanchum glaucum,	see Herbs, Opposite, Exstipulate, Simple, Entire.
Cynanchum Jacquemontianum,	see Herbs, Opposite, Exstipulate, Simple, Entire.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Leptadenia spartium,
Kip.
ASCLEPIADACEÆ.
F. B. I. iv. 64.
The Plains.

small, smooth, with long erect twiggy branches sometimes leafless, leaves few, 3-4 by $\frac{1}{4}$ in., narrowly linear, shortly stalked, leathery ; flowers dirty yellow white $\frac{1}{8}$ in. diam. in solitary or double clusters of several flowers, corolla rotate like the spokes of a wheel, thick, velvety on both surfaces, calyx lobes obtuse, minute scales between the corolla lobes, staminal tube with a wavy ring round it ; follicles 5 by $\frac{1}{3}$ in., solitary by abortion, cylindric, straight with a long slender beak ; seeds $\frac{1}{2}$ in. long with a tuft of hairs, ovoid. The branches are used in Sind to make well ropes.

Orthanthera viminea,
Kip, mahur.
ASCLEPIADACEÆ.
F. B. I. iv. 64.
The Plains to 3,000 ft.

small with erect twiggy branches generally leafless, leaves very few, 2 by $\frac{1}{8}$ in., on branches near the ground not on flowering branches ; flowers in woolly stalked clusters $\frac{1}{4}$-1 in. long, calyx lobes lanceolate, corolla $\frac{1}{6}$ in. long, flat topped, not rotate, lobes erect, brownish orange, minute scales between the lobes, staminal tube with a wavy ring round it ; follicles 5 ins. long, solitary, linear ; seeds $\frac{1}{5}$ in. long with a tuft of very fine silky hairs $\frac{1}{2}$ in. long. Near Delhi the fibre is used to make ropes.

Buddleia paniculata,
Chiti boi, dholeu.
LOGANIACEÆ.
F. B. I. iv. 81.
Himalaya, 4–7,000 ft.
Simla, Fagu, Matiana (Collett).

large, bark thin, pale grey peeling off in long pieces ; leaves ovate or oblong, 5 by 2 ins., upper ones lanceolate, lower toothed, white woolly beneath united by a slight ridge across the branchlet ; flowers $\frac{1}{2}$ in. long, in interrupted leafy branching racemes, usually terminal on branches, calyx lobes 4, persistent, blunt, corolla tube pink, orange inside, lobes 4, blue (sometimes the flower is white or pink), fragrant, stamens 4, very short ; capsule $\frac{1}{4}$ in. long, ovoid, woolly, seeds many.

Buddleia asiatica,
Bana.
F. B. I. iv. 82.
The Plains to 5,000 ft.

medium sized, bark thin, grey, ends of branches densely clothed with short white wool ; leaves 3-6 by 1-1½ ins., lanceolate, smooth and dark green above, dense short white wool beneath, united across the branchlets by a slight ridge, flowers crowded in long,

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

slender, usually drooping spikes, often united into a terminal branching raceme, fragrant, sessile, $\frac{1}{4}$-$\frac{1}{3}$ in. long, calyx lobes 4, long, pointed, corolla white, turning to purple, lobes 4, short, stamens 4, short; capsule $\frac{1}{4}$ in. long, smooth.

Tecoma undulata,

see Trees, Opposite, Exstipulate, Simple.

Petalidium barlerioides,
ACANTHACEÆ.
F. B. I. iv. 416.
Himalaya, 1-3,000 ft.

small, finely velvety, stems several cylindric, bark peeling in long papery strips; leaves 2-4 ins. long, ovate, toothed, acute; flowers pale blue or white, tinged with yellow solitary or in small clusters, bracts none, bracteoles 1 in. long, ovate, not veined, enclosing the lower part of the flowers, sepals 5, linear, corolla 1$\frac{1}{4}$-1$\frac{1}{2}$ ins. long, tube cylindric, hairy within, corolla limb not two-lipped, 5 lobes, nearly equal, stamens 4; capsule $\frac{1}{2}$ in., ovoid, flattened, usually two seeded.

Dædalacanthus nervosus,
ACANTHACEÆ.
F. B. I. iv. 418.
Himalaya, 1-3,000 ft.
Sutlej Valley (Collett).

medium size, roughly pubescent; leaves 6 by 3 ins ovate pointed; flowers deep blue in short uninterrupted crowded spikes forming clusters, bracts $\frac{1}{2}$ in. long, ovate, long pointed, variegated green and white, concave, enclosing the lower part of the flower, corolla 1$\frac{1}{4}$ in. long, tube cylindric dilated near the top, corolla limb not two-lipped, spreading, five-lobed, stamens 2; capsule $\frac{1}{2}$ in. solid, cylindric; seeds 4, finely hairy.

Æcmanthera tomentosa,
Patrang, *banmaru*.
ACANTHACEÆ,
F. B. I. iv. 428.
Himalaya, 3-5,000 ft.
Valleys below Simla, Subathu (Collett).

small, stems hairy, grey or white; leaves 2-4 by 1-2 in., acute shortly toothed, hairy above, white woolly beneath; flowers come out at intervals of 4-5 years, pale blue or purple, sessile in small clusters along the spreading branches of a terminal raceme, bracts and bracteoles hairy glandular linear equal to the calyx: corolla 1 in. long, tube cylindric widened near the middle, limb $\frac{1}{2}$ in. diam., lobes 5, rounded, stamens 4, style filiform, often divided; capsule linear, $\frac{1}{3}$ in. long, splitting to the base, seeded to the bottom, seeds 6-8, hairy when wetted.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Strobilanthes glutinosus, ACANTHACEÆ. F. B. I. iv. 458. Himalaya, 3-6,000 ft. Valleys below Simla (Collett).	medium size, sticky, hairy ; leaves 3 by $1\frac{1}{4}$ in., ovate toothed, hairy on both sides ; flowers pale blue on short spikes forming a round head or often the lowest flowers are separated, solitary in the axil of leaf like bracts ; upper bracts $\frac{1}{4}$-$\frac{1}{3}$ in., ovate shorter than the calyx, bracteoles $\frac{1}{3}$ in. oblong, calyx sticky hairy, lobes linear ; corolla 2 in. long, tube lower half cylindric, upper dilated, limbs spreading, lobes 5, stamens 4 ; style linear hardly bifid, capsule $\frac{3}{4}$ in. oblong, sticky velvety, seeds ovate hairy.
Strobilanthes Dalhousianus, ACANTHACEÆ. F. B. I. iv. 460. Himalaya, 6-8,000 ft. Simla, Mahasu (Collett).	medium size, hairy ; leaves 3-6 by $1\frac{1}{4}$-2 in., pointed at both ends, hairy toothed ; flowers dark blue or purple in heads of three or very short spikes, bracts $\frac{1}{1}$ in. orbicular, concave, smooth, whitish, bracteoles none ; calyx slightly velvety, nearly smooth ; corolla $1\frac{1}{2}$-2 in. long, tube yellowish, curved, gradually swollen from near the base, limb $\frac{1}{2}$-$\frac{3}{4}$ in. diam., purple, lobes 5, rounded, stamens 4 ; capsule $\frac{2}{3}$ in. long, oblong, velvety ; seeds 4 ovate, silky.
Strobilanthes alatus, including **S. angustifrons,** ACANTHACEÆ. F. B. I. iv. 464 and 466. Himalaya, 6-10,000 ft. Mashobra (Collett).	medium size, sticky hairy ; leaves 5 by $2\frac{3}{4}$ in., hairy, long winged stalks, ovate, sharply toothed, long pointed, flowers dark blue in interrupted spikes or in clusters, bracts soon falling off, narrow hardly as long as the calyx, bracteoles $\frac{1}{5}$ in., soon falling off ; corolla $1\frac{1}{4}$ in. long, tube curved, gradually dilated from close to the base, limb $\frac{3}{4}$ in. diam., lobes 5, stamens 4 ; capsule $\frac{3}{4}$ inch, narrow, glandular hairy, seeds 4, ovate hairy.
Lantana Camara, VERBENACEÆ. F. B. I. iv. 562. The Plains.	rambling, rough, branches four-angled with recurved prickles ; leaves 3 in. long, ovate, rough above. woolly beneath, stalk $\frac{1}{4}$ in. long ; flowers scented in stalked ovoid heads, bracts longer than the calyx, corolla tube pink, slender, $\frac{1}{3}$ in. long, mouth $\frac{1}{4}$ in. diam., lobes spreading, 4-5, orange or yellow, stamens 4, style 1, stigma oblique ; drupe $\frac{1}{8}$-$\frac{1}{5}$ in., purple, 2 bony cells. An American plant.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Lantana indica, VERBENACEÆ. F. B. I. iv. 562. The Plains to 3,000 ft. Valleys below. Simla (Collet)	same as above but no recurved prickles, flowers smaller, not so strongly scented, corolla tube yellow, lobes pink.
Callicarpa macrophylla. *Bauna, sumali, denthar.* VERBENACEÆ. F. B. I. iv. 568. The Plains to 6,000 ft. Valleys below Simla (Collett)	medium size, stem hardly any, branches, leaf stalks, and flower parts covered with dense tawny wool; leaves 4-7 in., ovate, long pointed, minutely toothed, woolly with stellate hairs beneath, leaf stalk $\frac{1}{4}$-$\frac{1}{2}$ in.; flowers $\frac{1}{5}$ in. long, pink, crowded in axillary short stalked clusters, round 1-3 in. diam., calyx bell-shaped, 4 toothed, corola short spreading, lobes 4 nearly equal, stamens 4, protruding, style long: very round white, fleshy, nutlets 4, one-seeded.
Holmskioldia sanguinea, VERBENACEÆ. F. B. I. iv. 596. Himalaya to 4,000 ft. Valleys below Simla, Subathu (Collett).	large, straggling; leaves 3-4 by 2-3 ins., ovate, long, pointed, shortly toothed, stalk $\frac{1}{2}$ in., flowers in short clusters in the axil of leaves or at the ends of branches, calyx conspicuous, brick red, persistent, widely open, $\frac{3}{4}$-1 in. diam., corolla $\frac{1}{3}$-$\frac{3}{4}$ in., cylindric curved, bright red, lobes 5, short, stamens 4, projecting, style bifid; drupe $\frac{1}{5}$-$\frac{1}{4}$ in. deeply four-lobed, seeds 1-4, oblong.
Caryopteris Wallichiana, VERBENACEÆ F. B. I. iv. 597. Himalaya to 5,000 ft. Valleys below Simla (Collett).	medium size, spreading; bark peeling in long, papery flakes; young shoots grey velvety; leaves 4 by 1 in., lanceolate, long pointed, minutely dotted with yellow glands; flowers pale mauve in clusters forming a long pyramidal branching raceme at the ends of branches, corolla tube very short, lobes spreading, five, $\frac{3}{4}$ in. diam., four upper lobes equal, lowest larger notched.; stamens four, in two pairs, far protruding, style bifid; capsule round, dark blue, 4-lobed, separating into 4 concave valves carrying each a single seed.
Plectranthus ternifolius,	see Herbs, Erect, Opposite, Exstipulate, Simple, Toothed.
Pogostemon plectranthoides,	see Herbs, Erect, Opposite, Exstipulate, Simple, Toothed.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Colebrookia oppositifolia,
Pansra, shukardana.
LABIATÆ.
F. B. I. iv. 642.
Salt range. The Plains 1-4,000 ft. Valleys below Simla, Dharmpur, Suni (Collett).

medium size, woolly, bark grey, leaves 4-10 by 1½-3 in., lanceolate, long pointed, velvety-wrinkled above grey and woolly beneath, leaf stalk ½-1 in., stout, white-felted; flowers male and female often on different plants, minute, white, in clusters 2-4 in. long on many branched spikes, corolla white, lobes rounded, stamens 4, within the corolla in females, protruding in males; style bifid and protruding in females, none in males; nutlet usually one, tip hairy contained in the much enlarged calyx of which the segments are feathery, the tips often purple.

Elsholtzia polystachya,
Rangchari, pothi.
LABIATÆ,
F. B. I. iv. 643.
Himalaya, 7-9,000 ft. Simla (Collett).

medium size, velvety, bark grey peeling in long strips, branches scarcely 4 angled; leaves 3-6 in. long, nearly sessile, lanceolate, toothed, long pointed; flowers white or pale yellow, minute in cylindric slender spikes, 4-6 in. long, bracts minute, calyx bell-shaped, 5-toothed, enlarged in fruit, corolla tube longer than the calyx, 4-lobed, upper lobe nearly erect, notched, the other spreading, stamens 4 in unequal pairs, protruding, style unequally bifid, nutlets 4, narrow, one-seeded.

Meriandra strobilifera,
Kafurka pat.
LABIATÆ.
F. B. I. iv. 652.
Himalaya, 5-6,000 ft. Valleys below Simla (Collett).

small, woolly, smelling of sage, branches somewhat angled; leaves 3-4 by ¾-1¼ ins., thick, oblong or lanceolate, shortly toothed, two portions projecting backwards in points, velvety and closely wrinkled above, white woolly beneath, stalk very stout, ¼ in. long; flowers white, small in large circular clusters crowded in erect woolly four sided spikes with floral leaves (bracts) small, sessile, ovate, overlapping; calyx two, lipped, corolla four-lobed, spreading, stamens 2, short, stout, protruding, style bifid; nutlets brown smooth.

The leaves are used as a gargle in sore throats in native medicine.

COROLLA TWO-LIPPED.

Justicia Betonica, see Herbs, Erect, Opposite, Exstipulate, Simple.

Justicia pubigera, see Herbs, Erect, Opposite, Exstipulate, Simple.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

COROLLA TWO-LIPPED.

Adhatoda Vasica,
Bhekar, bansa, vasaka.
ACANTHACEÆ.
F. B. I. iv. 540.
The Plains to 2,500 ft. Valleys below Simla (Collett).

arge, with a fetid smell, not eaten by goats; leaves 4-8 by $1\frac{1}{2}$-3 ins. oblong, narrowed at both ends. minutely velvety, stalk 1 in.; flowers white in short dense bracteate spikes of 2-4 ins. in length, bracts $\frac{3}{4}$ by $\frac{1}{2}$ in., green, ovate sessile, bracteoles $\frac{3}{4}$ by $\frac{1}{5}$ in., corolla two-lipped, $1\frac{1}{4}$ in. long, lower lip with pink streaks, tube short barrel-shaped, stamens 2; capsule $\frac{3}{4}$ in., velvety, four-seeded, seeds $\frac{1}{3}$ in. diam., warty. The leaves are used to cure bronchitis; not browsed by animals.

Rhinacanthus communis,
Palak-juhi,
ACANTHACEÆ.
F. B. I. iv. 541.
The Plains, in gardens.

medium size; leaves 3-4 by $\frac{3}{4}$-$1\frac{1}{4}$ in., narrowed at both ends, margins wavy, stalk $\frac{1}{3}$ in.; flowers white in large spreading terminal clusters, bracts and bracteoles $\frac{1}{12}$in., linear; corolla 1 by $\frac{1}{10}$ in., tube very long, narrow cylindric, two-lipped, upper lip two-lobed, lower three-lobed, stamens 2; capsule four-seeded, seeds ovoid, flatten e slightly warty. The leaves are used as a cure for Dhobies itch, rhinacanthin is like chrysophanic acid.

Graptophyllum hortense,
ACANTHACEÆ,
F. B. I. iv. 545.
The Plains.

medium size, smooth, often variegated; leaves $4\frac{1}{2}$ by $1\frac{3}{4}$ ins., shortly stalked, oblong, narrowed at both ends. margin smooth; flowers crimson in terminal ovate clusters, bracts and bracteoles narrow, very small. corolla tube curved, two-lipped, upper lip 2-lobed. lower 3-lobed, stamens two large, two small (staminodes); capsule contracted into a long stalk. oblong. hard: seeds 2, flat orbicular, pitted.

Clerodendron serratum,
Banbakri, barangi.
VERBENACEÆ.
F. B. I. iv. 592.
The Plains, East of the Sutlej river.

hardly woody, stems annual from a woody rootstock, as it is usually burnt down in jungle fires; leaves sometimes in circles of three, 4-8 by $1\frac{1}{2}$-$2\frac{1}{2}$ inches. oblong, toothed, smooth, shortly stalked; flowers bluish-white in terminal branching racemes, when almost linear 6 by 1 in., when almost pyramidal 10 by 5 ins., bracts $\frac{1}{2}$-$1\frac{1}{2}$ inches often coloured, corolla tube $\frac{1}{3}$-$\frac{1}{2}$ in., narrow, cylindric, mouth oblique. two-lipped

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

COROLLA TWO-LIPPED.

lobes $\frac{1}{3}$-$\frac{1}{2}$ in., oblong, stamens 4, far protruding, drupe $\frac{1}{4}$ in. diam., black, succulent, 1-4 stones. The root is used in native medicine as a febrifuge.

Clerodendron infortunatum,
Bhant.
VERBENACEÆ.
F. B. I. iv. 594.
The Plains to 1,000 ft.

medium size, bark with large raised corky excrescences, fetid smell; leaves 4-8 by 3-5 ins., broadly ovate, hairy above, woolly or thinly hairy below, sometimes with sticky glands, slightly toothed; flowers white, tinged with red, in branching terminal racemes, 6-12 by 4-8 ins., erect, sometimes leafy, upper part and calyces turning red, hairy, corolla tube nearly 1 in., long, cylindric, doubtfully two-lipped, lobes $\frac{1}{3}$-$\frac{1}{2}$ in. long, acute, stamens 4, much exceeding the lobes, style bifid; drupes $\frac{1}{3}$ in. diam., black, succulent, enclosed in the enlarged bright red leathery calyx. The leaves are used as a febrifuge in native medicine.

Plectranthus rugosus,
Piumar, solei.
LABIATÆ.
F. B. I. iv. 620.
Himalaya, 3-8,000 ft.
Simla (Collett).

small, hoary with stellate down, branches slender, stiff erect; leaves 1-1$\frac{1}{2}$ in. long, ovate or oblong, toothed, bluntly tipped, velvety above, white, woolly beneath; flowers white, spotted and streaked with purple, in clusters forming narrow leafy axillary or terminal racemes, calyx woolly, $\frac{1}{6}$ in. long, bell-shaped, lengthened in fruit, teeth sharp short pointed, nearly equal, two-lipped, corolla $\frac{1}{6}$ in., two-lipped, longer than the tube, lower lip longest, boat shaped, stamens 4, in unequal pairs, lying along the lower lip, style unequally divided; nutlets 4, round or oblong, blunt. As the native name implies, this plant is used to keep fleas away.

Ocimum Basilicum,

see Herbs, Erect, Opposite, Exstipulate, Simple Toothed.

Ocimum sanctum,

see Herbs, Erect, Opposite, Exstipulate, Simple, Entire.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

COROLLA TWO-LIPPED.

Orthosiphon pallidus, see Herbs, Erect, Opposite, Exstipulate, Simple, Toothed.

Thymus Serpyllum, Thyme.
Banajwain, masho.
LABIATÆ.
F. B. I. iv. 649.
Himalaya, 5-13,000 ft.

small, slender, much branched, strongly scented, stems usually somewhat procumbent ; leaves ⅛-¼ in., nearly sessile, gland dotted, oblong, ovate, not toothed, blunt; flowers small, purple in small clusters, crowded in short terminal spikes, corolla two-lipped, upper lip almost erect, flat, notched, lower spreading, three-lobed, stamens 4, equal, protruding ; nutlets 4, nearly smooth. This plant is used in native medicine for diseases of the eyes and stomach.

Hyssopus officinalis,
Zufah yabis.
LABIATÆ.
F. B. I. iv. 649.
Himalaya, 8-11,000 ft.

small, smooth, stem below branched, woody, branches erect ; leaves sessile, lanceolate, ⅓ in. long ; not toothed ; flowers bluish-purple in axillary or terminal spikes, calyx 2-lipped, 5-toothed, corolla two-lipped, upper lip erect, notched, lower spreading three-lobed, middle lobe very broad, stamens 4, unequal, protruding ; nutlets narrow, smooth, three-cornered. This plant was once used in Europe as a tonic and stimulant.

Micromeria biflora,
LABIATÆ.
F. B. I. iv. 650.
Himalaya, 1-7,000 ft.

dwarf, prostrate, hairy, woody, branches very numerous tufted, leafy, slender, something like Thymus in appearance but not scented ; leaves ⅙-¼ in., sessile, ovate, short pointed, toothed or not , flowers pink stalked, small in axillary circles of one to four, calyx 5-toothed equally, 13 nerved, corolla two-lipped, upper lip erect, notched, lower three-lobed, spreading, stamens 4 in unequal pairs ; nutlets smooth.

Micromeria hydaspidis,
LABIATÆ.
F. B. I. iv. 650.
Western Kashmir.

very small, stem erect, rather stout ; leaves ½-¾ in., shortly stalked, minutely toothed, ovate, obtuse ; flowers shortly stalked in continuous or interrupted crowded circular clusters forming spikes, otherwise like the last.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

COROLLA TWO-LIPPED.

Salvia ægyptiaca, *Tukhm malanga.* LABIATÆ. F. B. I. iv. 656. The Plains. 1-2,000 ft.	very small, rough, hairy ; branches widely separating from the base, rigid ; leaves $\frac{3}{4}$ in., small, nearly sessile, few, linear, rigid acute, minutely toothed ; flowers in small circular clusters on slender branching racemes, whitish lilac, $\frac{1}{4}$ in. long; bracts small, lower leaf-like, upper lanceolate ; calyx glandular hairy, two-lipped, upper lip orbicular, minutely toothed, corolla two-lipped, upper lip nearly straight, short, flattened, concave, stamens 2, style 2-fid ; nutlets $\frac{1}{12}$ in. long, narrow, oblong, black. The seeds are used in native medicine as an astringent.
Stachys tibetica, LABIATÆ. F. B. I. iv. 677. Northern Kashmir, 10-14,000 ft.	rootstock, woody, thick, stems twiggy ; leaves $\frac{1}{2}$-$1\frac{1}{2}$ inches long, obtuse, nearly sessile, shortly stalked, sometimes irregularly lobular ; flowers pink sessile in small circular clusters axillary, calyx $\frac{1}{2}$ in., bell-shaped, tips long, corolla $\frac{3}{4}$-1 in. long, two-lipped, upper lip erect, long, narrow, lower spreading, three-lobed, middle lobe largest, stamens 4 ; nutlets $\frac{1}{8}$ in. long, broadly oblong.
Stachys parviflora,	see Herbs, Opposite, Exstipulate, Simple. Toothed, Corolla two-lipped.
Roylea elegans, LABIATÆ. F. B. I. iv. 679. Himalaya, 2-5,000 ft. Sutlej and Giri Valleys, (Collett).	medium size, branches cylindric, pale brown, finely woolly ; leaves 1-$1\frac{1}{2}$ ins., ovate, deeply toothed or lobed, woolly beneath ; flowers white tinged with pink, $\frac{1}{2}$ in. long in circular axillary clusters, calyx 5-lobed, 10 ribbed, rigid, corolla two-lipped, upper lip erect hood-like, lower three-lobed, spreading, mid lobe longest, margin even, stamens 4, unequal, outer or anterior pair longest ; nutlets $\frac{1}{8}$ in. This plant is lemon scented.
Otostegia limbata, LABIATÆ. F. B. I. iv. 679. Salt range, Lower hills west of the Jhelum.	small grey spinous, branches white, woolly, cylindric, spines $\frac{1}{2}$-$\frac{3}{4}$ in. long ; leaves 1 in. long, nearly sessile, grey on both sides ; bracts spiny ; flowers orange-white in circular clusters with bracteoles spiny, calyx two-lipped, upper lip very short, three-angled, lower very large, broad, toothed, hairy, corolla $\frac{1}{2}$ in. long,

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

COROLLA TWO LIPPED.

tube short, two-lipped, upper lip very long, hairy; stamens 4, protruding; nutlet $_5$ in. flattened, smooth in the enlarged calyx which forms a five-angled toothed cup $\frac{2}{3}$ in. diam.

Phlomis Stewartii,
LABIATÆ.
F. B. I. iv. 692.
Salt range and Suliman range, 2,500—4,500 ft.

small, densely stellately woolly, stem stout woody, short, branches cylindric spreading; leaves 3-5 by $\frac{1}{4}$-$\frac{3}{4}$ in., very leathery, linear lanceolate, awl-like, rough above; flowers small in circular clusters one in. diam.; bracts stout narrowly linear, calyx $\frac{1}{2}$ in., densely woolly angled, teeth very short, turned back, corolla small, two-lipped, upper lip concave, crest, villous, lower spreading, three-lobed, stamens 4, style unequally 2-fid; nutlets very small, three cornered, top smooth.

PETALS NONE.

Boerhaavia elegans, see Herbs, Erect, Opposite, Exstipulate, Simple, Entire.

Cyathula tomentosa, see Herbs, Erect, Opposite, Exstipulate, Simple, Entire.

Cyathula capitata, see Herbs, Erect, Opposite, Exstipulate, Simple, Entire.

Pupalia lappacea, see Herbs, Erect, Opposite, Exstipulate, Simple, Entire.

Haloxylon recurvum,
Khar, laghme.
CHENOPODIACEÆ.
F. B. I. v. 15.
The Plains. Salt range to 2,500 ft.

medium size, straggling, smooth covered with a hoar frost-like bloom, dark brown; branches opposite, jointed, separating widely, stiff or bent back, ending straight spines 2-6 ins. long, joints of stem, $\frac{1}{2}$-$\frac{3}{4}$ in., apart of spikos $\frac{1}{4}$ in.: leaves $\frac{1}{8}$-$\frac{1}{3}$ in., three-angled or nearly cylindric, ovate, obtuse or acute; flowers small, solitary or in spikes in the axils of leaves, bracteoles two, sepals 5, concave, increasing in fruit and horizontally winged; stamens 5 or less on the margin or base of a cup-shaped depression; fruit one-seeded, one-celled with skin, seed horizontal.

SHRUBS WITH OPPOSITE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Haloxylon multiflorum,
Lana, gora lana, shori lana.
CHENOPODIACEÆ.
F. B. I. v. 16.
The Plains. Salt range to 2,000 ft.

small, pale, much branched, almost leafless, jointed branches, stem very stout, 4-6 ins. high, branches in clusters; leaves consist of two broad very rounded, tips on each joint; flowers on short spikes, bracteoles, round concave; sepals very short obtuse, in fruit the sepals have round membranous fan-shaped wings and are $\frac{1}{2}$ in. diam., stamens 5 with alternating rounded staminodes.

Anabasis phyllophora.
CHENOPODIACEÆ.
F. B. I. v. 18.
The Plains by the Jhelum river.

dwarf, smooth, pale, almost leafless, stems many, erect, stock woody, joints long ending in two acute triangular teeth (leaves ?), flowers in the axils of joint-leaves, fruiting calyx with three wings arching over one larger than the others, seed erect, circular, flattened; in other respects very like Haloxylon.

Anabasis setifera,
CHENOPODIACEÆ.
F. B. I. v. 19.
Salt range.

very like the last species, but the leaves are thick fleshy nearly cylindric with a bristle, soon falling off, axil of leaves woolly, floral leaves rounded, wings of fruiting calyx 3-5, transparent, circular with the base heart-shaped.

Euphorbia Tirucalli,
Sehud, sehnr.
EUPHORBIACEÆ.
F. B. I. v. 254.
The Plains.

large, stem green, bark brown fissured, branches numerous, at first slender like rushes, growing as thick as the finger; juice milky, leaves $\frac{1}{4}$-$\frac{1}{2}$ in. long soon falling off, obtuse, linear-oblong; flowers $\frac{1}{12}$ in. long, top-shaped, two leaves at the base of the short flower stalks, capsule $\frac{1}{4}$ in., dark brown, lobes flattened, velvety, seeds smooth, ovoid.

Buxus sempervirens, Boxtree,
Chikri, papri, shamshad.
EUPHORBIACEÆ.
F. B. I. v. 267.
Salt range. Himalaya, 5-9,000 ft. Simla, Mashobra, Mahasu (Collett).

large or small, much branched, bark yellowish grey, corky, fissured, branchlets four-angled; leaves $\frac{3}{4}$-3 by $\frac{1}{5}$-$\frac{1}{3}$ in., linear oblong, shining, leathery, tip acute rounded or with a shallow notch, stalk very short; flowers in short very dense axillary racemes, the terminal flower female, male flowers have sepals 4 in two rows, stamens equal in number to the sepals, female flowers have 6 sepals, two outer much smaller; capsule $\frac{1}{2}$ in. long, ovoid, three-cornered with three horns, thick like handles to an urn, seeds 3-6, small. On the Salt range it is dwarfed, leaves $\frac{1}{2}$-1 in. long.

Shrubs with Opposite Exstipulate Lobed Leaves.

Stachys tibetica, see Shrubs, Opposite, Exstipulate, Simple, Petals United.

Roylea elegans, see Shrubs, Opposite, Exstipulate, Simple, Petals United.

Shrubs with Opposite Exstipulate Compound Leaves.

Jasminum officinale,
Chamba, bansu.
OLEACEÆ.
F. B. I. iii. 603
Himalaya, 3–9,000 ft.
Fagu, Narkanda (Collett).

sometimes climbing, branches long, weak, slightly grooved, dark green ; leaves 2-4 ins. odd, pinnate, leaflets 3-7, ovate, long pointed, terminal leaflet 1-2 ins.; flowers white, fragrant, $\frac{3}{4}$ in. long in terminal clusters of 1-10 flowers, calyx teeth nearly as long as the corolla tube, corolla top flat circular, tube cylindric, $\frac{2}{3}$ in. long, lobes 5, spreading, $\frac{1}{3}$ in. long, stamens 2, style 2-fid ; berry deeply two-lobed, oblong with rounded ends, $\frac{1}{3}$ by $\frac{1}{4}$ in.

Jasminum grandiflorum, Spanish Jasmine,
Chambeli, jati.
F. B. I. iii. 603.
Himalaya, 2–7,000 ft.
Simla (Collett).

sometimes climbing, branches angular, hanging down ; leaves 3-4 ins., odd pinnate, leaflets 3-7, sessile, ovate, end one $\frac{1}{2}$-1 in. long, the end leaflet often united to the next pair ; flowers white, tinged often with pink outside, very fragrant in loose clusters, calyx teeth linear, half the length of the corolla tube, corolla top flat, circular, tube $\frac{3}{4}$ in. long, lobes 5, $\frac{1}{2}$ in. long, stamens 2, style 2-fid ; berry two-lobed, with rounded ends, $\frac{1}{4}$ in. long.

Fraxinus xanthoxyloides, see Trees, Opposite, Exstipulate, Compound.

Vitex trifolia,
Pani ki-sanbhalu, safed sanbhalu.
VERBENACEÆ.
F. B. I. iv. 583.
The Plains.

large, bark thin grey ; leaves digitately compound, and simple, leafstalk 2 ins. long, leaflets 3, sessile 1-3 ins. long, smooth above, short grey wool beneath, and on shoots and racemes ; flowers lavender blue in branching terminal racemes 1-4 ins. long, often leafy at the base, calyx $\frac{1}{10}$ in., 5-toothed, corolla $\frac{1}{3}$-$\frac{1}{2}$ in., two-lipped, 5-lobed, mid lobe of lower lip largest, stamens 4, protruding ; drupe $\frac{1}{5}$ in., black, stone bony, 1-4 celled. This and the next plant are used in native medicine as tonics, febrifuges and expectorants.

SHRUBS WITH OPPOSITE EXSTIPULATE COMPOUND LEAVES.

Vitex Negundo,
Wana, marwan, nirgandi
VERBENACEÆ.
F. B. I. iv. 5833.
The Plains to 5,000 ft. Valleys below Simla (Collett).

very like the last species, but the leaves have five leaflets, the centre one usually distinctly stalked, and the flowers somewhat smaller, and a darker blue.

(*To be continued.*)

SOME NATURE NOTES.*

BY

LIEUT.-COLONEL R. G. BURTON, 94TH RUSSELL'S INFANTRY.

When I was asked by our Honorary Secretary to contribute a paper on the habits of tigers I replied that surely these habits had already been described down to the last stripe. At the same time Mr. Millard drew my attention to Mr. Selous' recent book *African Nature Notes and Reminiscences*, containing several chapters of notes on the lion, and it occurred to me that a comparative study of the habits and nature of the lion and tiger might be of interest. In reading Mr. Selous' book many points of similarity, or of marked differences, between these and other African and Indian animals occurred to me, and I was led to make comparative notes, from an Indian sportsman's point of view, with regard to my own experiences of matters referred to by the African hunter.

The Indian hunter has not the unrivalled opportunities of his African comrade for the observation of game. In this country there are none of those vast expanses, teeming with wild life and but seldom trodden by civilized man, which are still to be found in the interior of the Dark Continent. No sportsman has in India had the experiences of Gordon Cumming, William Cotton Oswell, and Selous. In India one cannot hunt all the year round. Neither the climatic conditions nor the habitat of the game admit of prolonged excursions. Still, although the days when great game abounded in this country are rapidly passing away, the sportsman who has wandered far afield has in the past twenty years been able to find abundance of animals. Certainly the British military officer has now less opportunity of obtaining sport than he had ten or fifteen years back. Work is more insistent; remote cantonments have been abandoned; irksome but perhaps necessary restrictions with regard to shooting have been introduced; native states that once afforded happy hunting grounds have been closed; and meanwhile with the spread of civilization, population has increased, cultivation has spread and pushed the wild animals into remoter fastnesses where there still remains sufficient forest for their wanderings; railways have cut up the jungle, and by rendering remote tracts of country accessible, have led to the diminution of game. Perhaps worst of all—native poachers have been able to obtain better weapons and to work greater destruction. The perfection of fire-arms has also had its influence in other directions. The hunter of the days of the Old Forest Ranger had to approach close to his game before his muzzle-loader could be effective; the pursuit of wary animals called for the exercise of more skill and knowledge of woodcraft than in these days of the death-dealing long-ranging magazine rifle. There is still, however, an abundance of game in India for those who have the leisure and the enterprise to look for it.

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In the plains of India one does not now-a-days find the herds of two and three hundred antelope, which I recollect seeing in the Berar Valley twenty years ago. These beautiful animals are still numerous; but their numbers are diminished. Jerdon mentions seeing herds of a thousand near Jalna. This would have been sixty years ago. In the same neighbourhood during the past ten years I have never seen large herds. Never shall I forget a scene in a forest glade on the Pein Gunga, witnessed fourteen years back. I followed on the tracks of a tiger up the bed of a dry water-course having a pool here and there where the great beast and other animals had stopped to drink. After some miles the water-course entered an open space, where a small forest bungalow stood amid a grove of trees. The sun had not long risen, and the umbrageous foliage of the trees, and the slender fronds of the bamboos cast long shadows across the glade. Here stood three or four herds of spotted deer, some browsing on the grass, some standing on their hindlegs to pluck the young shoots from the bamboos; a herd of nilgai was on the bank of the water-course; a pair of four-horned antelope were feeding beneath a banyan tree; monkeys, lungoors with grey fringed black faces, were clinging to the trees; peafowl in numbers were not far from a pool in the nullah; two wild dogs, which should surely have caused the disappearance of all this game, stood unconcernedly in the middle of the space; there were before me tracks of a tiger and a panther, and a bear climbing in search of honey had scored deep marks with his claws on the bole of an adjacent tree; farther on up the hill-side, a sambar belled loudly, but was not in sight; perhaps the tiger, which was not far ahead of me, had passed that way. For some time, from concealment in the water-course, I watched this scene with interest. It seemed a pity to disturb it, but I wished to find where the tiger had gone. A cow bison with two calves also appeared on the edge of the forest. As I emerged into the glade, the nearest spotted hinds, whose dappled hides assimilated remarkably with their surroundings of sunlight and shade, uttered shrill barks of alarm; and soon all disappeared like spectres in the shades of the forest.

It is remarkable how the colouration of spotted animals blends with the light and shade of the sun shining through foliage. On one occasion I shot a leopard, which made off into a patch of bush between the leaves of which the sun was shining; creeping about among the bushes, it was some time before I could distinguish the animal, lying dead fortunately, within three or four yards of me. I have found the same difficulty in some localities when following up tigers, on one occasion in particular, when a wounded animal went into long grass, where it was almost indistinguishable. I have, however, always inclined to the opinion that the views of scientific naturalists with regard to protective colouration are rather far-fetched. Thus Mr. A. R. Wallace ascribes to it the purpose of concealing "herbivorous species from their enemies, and enabling carnivorous animals to approach their prey unperceived." For colouration to afford protection necessitates the absence of motion. With Mr. Selous, I am inclined to think that colouration is far more due to environment, to the colour of the surroundings and to climatic causes than to sexual selection for protective purposes. It is noticeable how animals become assimilated to the general colour of their surroundings, from which they probably take their complexion, as the arctic animals turn white in the snows of winter. In the case of fishes, this adaptation of colour to the environment takes place very rapidly: in a lake in Norway I have caught blue coloured trout where the blue glacier water run in; and black ones from dark holes among the rocks; and bright silvery fish in the more open water. The lower animals, in fact, appear to adapt themselves rapidly to the complexion of their surroundings. There is a species of spider in the south of France, which adapts itself to the colour of the flowers it frequents, and will change its colour in a few days when transferred from one flower to another of different hue. This is typical of changes due to environment throughout the animal world, although the mammalia do not change colour so rapidly. But the animals of a species haunting dark thickets or sombre woods take on a darker hue than those of their kind in more open country. A similar environment may produce similar colouration in widely different parts of the world in creatures of different genus. Food may also affect colour.

We see so many shades of difference in colour and colouration between individuals of one species, and even of one herd, that sub-specific distinctions based on such differences must be entirely fallacious, although scientific naturalists appear to be so greatly addicted to the adoption of sub-specific nomenclature on the slenderest grounds of this nature. It is interesting to note that lower animals and birds undergo greater change during the breeding season than mammalia. At the same time some antelopes change colour considerably at certain periods of the year. The black buck's jet black coat becomes a dull dark-brown.

With regard to protective colouration, Mr. Selous very truly writes that well-known naturalists appear to assume "that both carnivorous and herbivorous animals trust entirely to their sense of sight, the former to find their prey and the latter to avoid the approach of their enemies." But I must join issue with him when he says that "nothing is more certain than that all carnivorous animals hunt almost entirely by scent." In my experience neither the tiger nor panther hunt by scent, but depend almost entirely on sight and perhaps hearing. This has been proved time and again by these beasts of prey passing close to buffaloes or goats, tied up as bait, without seeing them, owing to the bait having made neither sound nor movement. I have known many occasions when a tiger has passed close to an animal thus tied up, and has killed another a few hundred yards farther on. For this reason, that they hunt by sight and not by scent, one ties up the bait on or near a path or water-course or near a pool of water, so that the prowling tiger may come upon it in the course of his nightly wanderings. The African hunter tells us that the zebra's stripes do not assimilate well with its surroundings, except at dawn and late in the evening. But striped forms, such as the tiger, certainly blend remarkably with moonlight or the dusk of early night and dawn. There is a wonderful instance of colouration blending with the surroundings in a photograph of Somali giraffes, taken by Lord Delamere and reproduced in Mr.

Lydekker's *Game Animals of Africa*. The giraffes are feeding among mimosa trees, from which it is difficult to distinguish them. Mr. Selous considers that this photograph, which eliminates colour, is misleading; and that the animals cannot constantly live among mimosa trees, which are scarce. But Sir Samuel Baker wrote many years ago with regard to this animal. "It is exceedingly deceptive in appearance when found in its native forests. The red-barked mimosa, which is its favourite food, seldom grows higher than fourteen or fifteen feet. Many woods are almost entirely composed of these trees, upon the flat heads of which the giraffe can feed when looking downwards. I have frequently been mistaken when remarking some particular dead tree stem at a distance, that appeared like a decayed relic of the forest, until, upon nearer approach, I have been struck by the peculiar inclination of the trunk; suddenly it has started into movement and disappeared." So the photograph appears in this instance to be remarkably true to life.

I have observed the adaptation of colour to environment especially in the desert-born, such as in Baluchistan, where one sees markhor, oorial, chikor, see-see partridges, desert larks, and in fact all the dwellers of the wilderness taking the hue of their surroundings. The protective theory has been carried to an absurd extent by some naturalists, as when it has been suggested that the melanism of the black panther of Java is for the purpose of facilitating the chase of the black apes on which it preys. The observations of most experienced field naturalists more probably will lead them to believe that colour and colouration are chiefly affected by environment, and that protection is less a cause than an effect.

The carnivorous animals of Africa and India appear to be alike in being seldom seen in the daytime, as they are nocturnal in their habits. In all his wide experience Mr. Selous has only once seen a lion hunting by daylight. I have known tigers kill by daylight on several occasions; once when I was sitting at breakfast at 9 o'clock in the morning a tiger killed one of my buffaloes within a hundred yards, and in sight of my tent. This was in the hot weather, and I recollect another kill taking place by day at the same season. In the cold weather, however, it is not uncommon to hear of tigers attacking cattle in the daytime. In describing the lion's method of hunting, the African sportsman says: "They seek their prey by scent, either smelling the animals directly or following their racks." As I have already said, tigers appear to hunt more by sight and hearing than by scent. They follow the paths or the water-courses as a rule, and so no doubt follow the tracks of other animals, for all game prefers a beaten path. They visit the various water-holes in their beat, and I have often found them frequent a beat with remarkable regularity. They catch animals drinking at the pools, or lie in concealment at such places and other suitable spots, and so surprise their prey. Mr. Selous also tells us that the leopard hunts by night and by scent. I have certainly always been under the impression, from general observations of its habits, that the Indian leopard or panther hunts by sight and sound. It is fond of prowling round villages to pick up stray goats or dogs, or of following in the wake of herds of goats, and carrying off stragglers; of wild animals, it preys on pigs, nilgai, and small game such as peafowl, hares, porcupines, and small deer. I shot one once that was well known as being in the habit of hunting monkeys of the lungoor species. It would be very unlikely to hunt monkeys by scent.

With reference to animal colouration, Mr. Selous remarks that lions prey largely on buffaloes, but little on giraffes; so if colouration is for protective purposes, the former surely require it the most. It is interesting to note that in South Africa, where these animals formed the principal food of the lions, the great carnivora used to live with and follow the larger herds in all their wanderings. I have similarly found tigers following and living in the vicinity of the large herds of Brinjara cattle in Hyderabad, when the Brinjaras moved from one pasturage to another, according to the season of the year.

Mr. Selous adduces evidence to show that man-eating lions are almost invariably old and worn-out animals, although the famous man-eaters of Tsavo by no means answered to this description. But he says that "in the vast majority of cases a lion only takes to killing human beings in its declining years, and when its strength is failing." The same idea is generally prevalent with regard to man-eating tigers. I have myself killed only two tigers that had been preying on human beings. One of these was known to have killed only two or three human beings; the other had devoured about a dozen people. Both were in the prime of life, and were not averse to cattle-killing. The latter would probably have become a confirmed man-eater, had his career not been put a stop to soon after he began killing human beings.

In the recorded instances of man-eating tigers and leopards we do not by any means find that they are generally animals in their declining years. It seems more probable that beasts of prey take to man-eating in the first instance more by accident than from any inability to kill other animals. They can kill domesticated cattle with equal facility, although decrepit animals might find a difficulty in killing game. Probably they in many instances begin man-eating by killing a herdsman or wood cutter, or other wanderer in the jungle, with no initial intention of devouring the prey ; and so they acquire a taste for human flesh. Mr. Selous mentions the bellowing of buffaloes being mauled to death by lions ; I have heard similar bellowing of an Indian domesticated buffalo being mauled to death by a brace of tigers which I shot next day. The popular idea of lions roaring when in search of prey has always struck me as being absurd, for it is not probable that the prey would await the approach of the roaring lion. Mr. Selous tells us that they hunt in silence, and on one occasion notes that lions " began to roar loudly, a pretty good sign that they had already dined and were not hunting." However, the roaring of lions is apparently a very common sound, and tigers seem to be much more silent animals, for I have very seldom heard them utter a sound, except when molested.

Lions and tigers appear to resemble each other in the method of killing their prey, by seizing it either by the throat or the back of the neck, and, in the case of large animals, by breaking the neck.

Mr. Selous mentions, as something very unusual, the killing of an elephant by lions. These beasts apparently sometimes hunt in large packs, so are doubtless able to tackle with facility very large animals. One reads of 15 to 20 lions together ; personally I have never seen more than three tigers, a tigress and two large cubs, in one party, but have heard of five. Saunderson mentions a tiger killing an elephant, and a similar occurrence is recorded in the *Asian* of 15th May 1900. It is related that one night on the Hanyani river a lioness broke into a piggery and killed nearly a hundred pigs. I have known a tiger kill five cows out of a herd, one after the other. Bears are sometimes no less destructive. In May 1889 I was encamped near Tilel on the Kishenganga in Kashmir when a brown bear killed ten sheep in a house in the village, carrying off two. This bear was especially addicted to sheep stealing, and his visits were marked by a heap of dead and dying found in the morning, killed, apparently, out of mere wantonness.

Mr. Selous has never seen any evidence of a lion killing its prey by striking it a heavy blow with one of its paws; my experience of tigers coincides with this; but I recollect seeing a thick copper dish, which a beater was carring on his back, battered by a tiger's paw, and with five claw-holes through it. The tiger appears to have seized or struck at the man in passing, but except for bruises the beater was uninjured.

A lion appears to charge in much the same way as a tiger or leopard, not in a series of leaps, as is popularly imagined, but coming along close to the ground like a great dog. Mr. Selous mentions that most of the men he has seen mauled by lions were bitten, and untouched by the claws. My experience in the main coincides with this; if there are claw wounds, they generally appear to be slight. A leopard which mauled me, after seizing my arm and bearing me to the ground, placed one paw on the calf of the leg, and seized the thigh in its jaws; the claw scratches on the calf were comparatively slight. The actual bite, as the African hunter notes, is practically painless. Mr. Selous mentions the eyes of wounded lions appearing to be ablaze; I have observed the same thing in the case of both tigers and leopards. He notes that troops of over twenty lions have frequently been seen. As already remarked, these animals differ from tigers in this respect. I have heard of a troop of six panthers being seen walking across a glade in the jungle in Berar.

It is surely time to protest against the tendency of naturalists to divide species into numerous local races or sub-species, each with an extra specific name, and frequently on the slenderest grounds. Thus in a recent natural history we find the lion divided into seven races, each with three latin names, the distinctions between them being based generally on colour and the extent of the mane. Such distinctions must be somewhat fallacious, and in view of what Mr. Selous says it is doubtful whether any naturalist can refer an assortment of lion skins, collected promiscuously, to their so-called "local races." Lions varying in colour, with black manes and yellow manes, of various development, and with no manes at all are found in one and the same district, and even in one and the same family. Mr. Selous relates that he shot north of lake N'gami two pairs of male lions, hunting together. In the case of both these pairs the animals living and hunting together differed from one another very much. In each case one was of a very dark colour all over, with a dark mane, whilst the body of the other was of a pale yellow, and it had scarcely any mane at all. A few days afterwards, two lionesses were shot on the same plain. One was about to give birth to three cubs; two of these cubs were males, one dark, the other reddish yellow; the fur of the female cub was lighter than the dark male. Mr. Selous is of opinion that the cubs would have grown up into animals differing in appearance as they differed before birth. The dark cub would have become a dark skinned, dark-maned lion, the lighter coloured one a yellow lion with probably very little mane. The scientific naturalist—had he received the skins of the two animals, would no doubt have referred them to different local races, perhaps from widely separated parts of the African Continent. Mr. Selous tells us also that out of fifty lion skins scarcely two will be found exactly alike in the colour and length of the mane. No doubt, as the African hunter points out, variations in amount of mane are frequently to be referred to the effects of climate. Thus, lions in captivity in a cold climate will develop a finer mane than those in a wild state. The Indian lion, generally almost destitute of mane, will grow a fine one when captive in Europe.

At any rate what Mr. Selous tells us regarding the variations of the lion shows the absurdity of this attempted division into local races. In the same manner we find other animals subdivided on insufficient grounds; as, for instance, the African buffalo, of which we are given some fifteen separate sub-species, each with its string of names, but regarding which Mr. Selous writes: "I do not for a moment believe that if a collection of 1,000 heads of buffalo bulls existed to-day, which had been brought together indiscriminately from every part of South Africa, anyone could tell from what district they came." In fact, he found the greatest variations in the horns even in a single herd, and it is on the form or shape of horn that the naturalist bases his subdivisional theories.

The same may be said with regard to many species of Indian animals, which are divided into sub-species or local races on the slenderest ground. The Baluchistan Gazelle is accorded a sub-specific status on the evidence of one female head, "the horns of which are distinctly, although not very prominently, ridged or ringed, and the dark portions of the face are dark-brown instead of rufous." Now these so-called distinctions are valueless. In the first place the horns of the female chikara throughout India are general annulated, while in one herd one may find animals with the dark portions of the face, some dark-brown and others rufous. Again we are told that the male of the Baluchistan Gazelle "was found not to differ perceptibly from the ordinary Indian chikara, except that the horns are a little more curved backwards, and slightly more lyrate when viewed from the front." This is also a fallacious reason for naming a local race; the horns of male chikara in a single herd or locality will be found to differ in these respects, some being more curved backwards and more lyrate than others.

This tendency towards a multiplication of sub-species or local races cannot be too strongly condemned, particularly when, as is frequently the cases, differentiation is based on the shape of horns, which vary so much in individuals, or on texture of fur, which changes according to climatic conditions.

As regards differences in texture of fur, it is only to be expected that animals whose habitat is in a cold climate will have under-fur, absent in the inhabitants of torrid zones. Yet this is frequently given as a reason for differentiation; colour, also is most misleading, although it is not infrequently quoted as an important mark of variation. Thus in a pack of either European or Indian wolves, one will find animals of several varieties of colour—grey, blackish, or rufous. The tiger in India is left alone in his glory, and not subjected to this hair-splitting process of division into local races; only the Manchurian and Persian animals are thus separated, by reason of texture of fur, which is referable to climatic causes, and size, which is scarcely of value in this connection, seeing how tigers vary in size, even in one locality.

The lion's method of opening and breaking up a carcase apparently differs in no respect from that of the tiger. Both animals generally remove the paunch and entrails intact, and drag the offal away to a short distance, sometimes covering it up. I find no mention of lions covering up the remains of their prey to preserve it from vultures;

this is frequently done by tigers, and I recollect how one large tiger which I shot had deposited the carcass of a buffalo in the middle of a pool of water, presumably with this object in view. Lions appear to be scavengers, for Mr. Selous says that "as long as they can find dead animals to eat, they will not take the trouble to hunt." I have not found tigers addicted to this habit. He mentions two instances of lions eating the flesh of their own kind. I have myself come across an instance of a tiger being given to cannibalism, and have heard of several other cases. In that which came under my notice, I had been following for several days a lame tiger, one of whose hind feet had "sat down," as though broken or dislocated, and so made a long track. The animal was going about with a tigress and a large cub. On kicking open one of its dry droppings one day, it was found to be composed of tiger's hair, in which a large intact claw was buried. From this evidence I came to the conclusion that the tiger had had an encounter with another of its kind, and had killed and devoured it, being himself lamed in the fight. I never killed this tiger, being unfortunately suddenly recalled from leave before I had time to bring this family party to bag.

The number of cubs in the case of the lion is generally two or three, but as many as six are sometimes given birth to. The same remarks apply to the tiger, except that I have not heard of more than four cubs at a birth.

Tigers are sometimes hard put to it for food. I have found remains of fish, crabs, bears and on one occasion a large python, eaten by them. They prey largely on porcupines, so that it is common to find quills embedded in their paws. I think I recorded in this Journal some years ago how one of my goats, tied up for a panther, was killed by a porcupine, a large quill having pierced the heart.

Mr. Selous mentions an instance of a wounded hyæna charging when followed up. It does not appear whether the animal was of the spotted or striped species. The latter, the only hyæna found in India, has the reputation of being a cowardly beast. I wounded one with small shot on one occasion, when beating for peafowl, and walked close up to it to finish it off, but it made not the slightest show of fight.

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

E. Meyrick, B.A., F.R.S., F.Z.S.

IX.

(*Continued from page 832 of Volume XVIII.*)

Cosmopterygidæ.

I have now broken up the family *Elachistidæ* as formerly constituted, and the family *Cosmopterygidæ* includes those genera with long sickle-shaped palpi and veins 7 and 8 of the forewings stalked, 7 terminating in costa, such as *Cosmopteryx, Stagmatophora,* and *Limnœcia*; in my last paper I termed this restricted group *Elachistidæ,* but now find that *Elachista* is referable elsewhere.

Zaratha Walk.

A genus of a few tropical species, having the antennæ much longer than forewings.

Zaratha prosarista, n. sp.

♂. 16-18 mm. Head grey with indigo-blue reflections, face bluish-silvery-white. Palpi whitish, anterior edge of terminal joint dark fuscous. Antennæ dark fuscous, becoming yellowish on sides and whitish beneath. Thorax dark grey, shoulders suffused with ochreous, beneath pearly white. Abdomen bronzy-ochreous, suffusedly irrorated with dark fuscous, beneath white, anal tuft ochreous, on sides white. Forewings linear, acute; dark fuscous, slightly purplish-tinged; a white streak along costa from base to $\frac{2}{3}$, suffused with yellowish towards base, leaving extreme costal edge dark fuscous towards base; lower edge of this streak at $\frac{1}{3}$ with a projection followed by an indentation and almost confluent with a suffused yellow-whitish spot on dorsum rather beyond it; a slender yellowish streak along fold throughout; a silvery-blue-metallic line above this throughout, extended along termen to apex, where it meets a silvery-blue-metallic subcostal line from $\frac{2}{3}$ to apex: an ochreous-yellow streak along lower margin of costal streak from indentation onwards extended between the two blue lines to near apex: cilia rather dark fuscous tinged with purplish, on apical third of costa white more or less wholly suffused with ochreous-yellow. Hindwings dark fuscous; an irregular elongate hyaline basal patch, divided into three spots by dark fuscous margins of cell; cilia dark fuscous.

Khasis, from October to March; nine specimens.

Zaratha dicellias, n. sp.

♀. 20-21 mm. Head prismatic bronzy-fuscous, sides of crown light ochreous-yellow. Palpi ochreous-yellowish, anterior edge of terminal joint dark fuscous. Antennæ fuscous, beneath yellowish. Thorax dark bronzy-fuscous with an ochreous-yellowish stripe on each side of back, beneath pearly white. Abdomen rather dark fuscous, beneath whitish-irrorated, and with broad whitish segmental bands. Forewings linear, acute; dark fuscous, slightly purplish-tinged; a light ochreous-yellowish streak along fold from base to middle, thence sinuate upwards, becoming thicker and proceeding close beneath costa to apex, from its lower edge beyond middle sending an equally thick branch to middle of termen, slenderly connected with upper branch on termen; between the two branches is a fine silvery-blue-metallic line: cilia dark fuscous tinged with purplish, on costa yellowish at base. Hindwings dark fuscous, obscurely subhyaline towards base in and beneath cell; cilia dark fuscous.

Khasis, in August; two specimens.

Cosmopteryx, Hb.

The species of this genus, notwithstanding their distinct and beautiful colouring, are very closely allied together, and require careful observation to perceive their distinctive characters. Twenty species are here recorded and to assist determination a tabulation of these is given; but it must be remembered that other closely allied forms doubtless exist; the only other Indian species described is *asiatica* Stt., which I have not included as I do not yet possess a specimen, though I have examined the type and consider it distinct from all these; the two other species doubtfully referred by Stainton to *Cosmopteryx* do not belong to the genus.

1.	Forewings with orange subcostal streak from base	*anadoxa.*
	„ without such streak	2
2.	Forewings with golden-metallic costal streak towards apex	*panopla.*
	„ without such streak	3
3.	Median line reaching band	4
	„ not „	6
4.	Subdorsal line reaching base	5
	„ not „	*hamifera.*
5.	Forewings with costal edge white towards base	*ingeniosa.*
	„ „ not „	*artifica.*
6.	Forewings ochreous-bronzy	*lætifica.*
	„ dark fuscous or blackish	7
7.	Transverse band yellow	8
	„ „ orange	10
8.	Median line very nearly reaching base	9
	„ not nearly reaching base	*manipularis.*
9.	Abdomen orange	*aculeata.*
	„ bronzy-grey	*spiculata.*
10.	Apical joint of antennæ blackish	11
	„ „ white	12
11.	Apical white line nearly complete	*mimetis.*
	„ „ reduced to a very short dash	*erethista.*
12.	Posterior metallic fascia entire	*holophracta*
	„ „ interrupted	13

13. Median white line reaching base 14
,, ,, not reaching base 15
14. Subcostal and median lines confluent posteriorly ... *vexillaris.*
,, ,, separate ... ... *licnura.*
15. Postmedian band bright orange 16
,, ,, dull fuscous-orange ... ... *cyclopæa.*
16. Median white line long ... ... *paltophanes.*
,, ,, very short 17
17. Costal edge shortly white before band ... ... *basilisca.*
,, not ,, ... 18
18. Forewings with short metallic anteapical dash ... 19
,, without such dash ... ... *artemidora.*
19. Forewings with white apical dot in cilia ... ... *catharacma.*
,, without such dot ... ... *belonacma.*

Cosmopteryx anadoxa, n. sp.

♀. 10 mm. Head bronzy-fuscous, with fine whitish lines above eyes, face paler. Palpi whitish lined with blackish. Antennæ blackish lined with white on basal half, apical six joints white except partially beneath, then about eight joints white with black tips. Thorax bronzy-fuscous. Abdomen rather dark fuscous, sides coppery-golden towards base. Posterior tibiæ blackish, with white median and apical rings and a silvery-metallic ring between them. Forewings very narrowly lanceolate, widest near base, apex very slenderly long-produced, caudate ; bronzy-fuscous ; a rather broad orange streak immediately beneath costa from base to $\frac{1}{4}$, its base golden-metallic ; a violet-golden-metallic streak from costa at $\frac{1}{5}$, curving round apex of orange streak and extended obliquely across wing to beyond fold but not reaching dorsum ; costal area between this and next fascia blackish as far as fold ; a violet-golden-metallic vertical fascia in middle, edged with blackish posteriorly, and a slightly oblique violet-golden-metallic fascia beyond $\frac{2}{3}$, strongly blackish-edged anteriorly, space between these suffused with dull orange towards costa ; from middle of last fascia an orange-yellowish sinuate line extends to apex : cilia dark fuscous with a white costal spot on posterior fascia. Hindwings and cilia dark fuscous.

Nilgiris, 3,500 feet, in May (Andrewes) ; one specimen.

Cosmopteryx panopla, n. sp.

♂. 9 mm. Head dark shining bronze, face lighter, with pale golden-metallic lines above eyes. Palpi dark fuscous, terminal joint suffused with whitish except towards base. Antennæ dark fuscous, with two or three scattered whitish rings towards apex (one antenna has some broad whitish suffusion below middle, perhaps an abnormality, as the other does not show it). Thorax dark shining bronze (defaced). Abdomen dark fuscous, on sides bright brassy-metallic. Posterior tibiæ blackish, with silvery-white median, subapical, and apical rings. Forewings very narrowly lanceolate, apex narrowly long-produced, caudate ; blackish ; two broad partially confluent golden-metallic longitudinal streaks occupying nearly all basal area, upper extending to near $\frac{1}{3}$, lower to $\frac{2}{5}$; a vertical violet-golden-metallic fascia slightly before middle, near beyond which is a subtriangular orange patch on costa; an erect transverse violet-golden-metallic spot on dorsum at $\frac{3}{5}$, whence proceeds a golden-metallic sinuate line to apex; a golden-metallic costal streak extending from close beyond orange patch half way to apex: cilia bronzy-blackish. Hindwings and cilia dark fuscous.

Hakgala, Ceylon, in April (Green); one specimen.

Cosmopteryx cyclopæa, n. sp.

♂. 8 mm. Head dark shining bronze, crown with three fine white lines, face light bronze. Palpi white lined with black. Antennæ blackish, dotted and towards base lined with white, four apical joints white, then five blackish, one white, one blackish, one white. Thorax dark bronzy-fuscous, with three fine silvery-white lines. Abdomen rather dark bronzy-fuscous, apex whitish-ochreous. Posterior tibiæ blackish, with silvery-white median and apical rings, and a silvery-metallic ring between these. Forewings very narrowly lanceolate, somewhat wider near base, apex slenderly long-produced, caudate; blackish; dorsal edge silvery-white towards base; three fine silvery lines before $\frac{1}{4}$, subcostal longest but not nearly reaching base, median intermediate in length, subdorsal very short, posterior extremities of all three equidistant from base; a broad dull fuscous-orange postmedian band, suffused with darker fuscous on costa and dorsum, anteriorly margined by a vertical violet-golden-metallic fascia, and posteriorly by two vertical-transverse violet-golden-metallic spots edged anteriorly by a few black scales, lower wholly anterior and not meeting upper if produced, the fuscous-orange colour projecting beneath but not beyond upper; a fine silvery-metallic dash midway between this and apex, and a short shining white line in apical cilia marked also on under surface: cilia otherwise dark fuscous, with a white costal spot on posterior margin of band. Hindwings and cilia dark grey.

N. Coorg, 3,500 feet, in February (Newcome); one specimen. This is the species which seems to approach nearest to *asiatica* Stt., from which however it is separated by the peculiar fuscous-orange band, and the metallic anteapical line not running into the apex; the arrangement of the metallic lines in the basal area is also characteristic.

Cosmopteryx erethista, n. sp.

♂ ♀. 8-9 mm. Head dark shining bronze, with a white line above each eye, face bronzy-whitish. Palpi whitish lined with blackish. Antennæ blackish, towards base lined with whitish, fourth and tenth joints whitish. Thorax dark shining bronze, with three fine white lines. Abdomen dark fuscous. Posterior tibiæ black with white median and apical rings. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate; blackish; dorsal edge white towards base; a transverse series of three very short silvery-white dashes about $\frac{1}{4}$, subcostal rather oblique and somewhat anterior to the other two; a broad orange postmedian transverse band irregularly sprinkled or mixed with blackish, edged by two strong violet-golden-metallic fasciæ, anterior vertical, blackish-edged posteriorly, posterior slightly oblique. blackish-edged anteriorly ; a very short white dash midway between band and apex ; a small white spot in apical cilia, marked also on undersurface : cilia blackish, with a white costal spot on posterior fascia. Hindwings and cilia dark fuscous.

Khasis, in November ; two specimens. Characterised by the absence of the usual white apical band of antennæ, black admixture of the orange band, entire posterior metallic fascia, and very short basal streaks.

Cosmopteryx holophracta, n. sp.

♂ ♀. 10-11 mm. Head dark bronze, with a white line above each eye, face silvery. Palpi white lined with blackish. Antennæ black, dotted and lined with white, three apical joints white, then five black, one white, one black, one white. Thorax dark bronze, with three fine white lines. Abdomen dark fuscous. Posterior tibiæ black with white median and apical rings, and a silvery ring between these. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate ; blackish ; dorsal edge silvery-white towards base ; a short fine silvery subcostal dash about $\frac{1}{5}$; a very fine silvery-white median line from base to about $\frac{1}{3}$; a short fine silvery-white dash beneath posterior portion of this ; a broad orange postmedian transverse band, edged anteriorly by a vertical violet-golden-metallic fascia black-edged posteriorly, and posteriorly by a rather oblique violet-golden-metallic fascia black-edged anteriorly : a pale violet-golden-metallic streak extending from before middle of apical area to apex ; a small white spot in apical cilia, marked also on undersurface : cilia blackish-grey, with a costal white spot on posterior fascia. Hindwings and cilia dark fuscous.

Khasis, in May and August ; two specimens. Distinguished from all the orange-banded species of the region by the combination of white arex of antennæ and entire posterior fascia.

Cosmopteryx licnura, n. sp.

♂ ♀. 9-11 mm. Head dark bronze, with a white line above each eye, face silvery. Palpi white lined with blackish. Antennæ black, dotted and lined with white, three apical joints white, then five black, one white, one black, two white. Thorax dark bronze, with three fine white lines. Abdomen dark fuscous, in ♂ with very large whitish-ochreous anal valves as long as thorax. Posterior tibiæ black with white median and apical rings, and a silvery ring between these. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate ; blackish ; dorsal edge silvery-white towards base ; three fine white lines on basal area, subcostal from base to $\frac{1}{4}$, rather oblique, median from base to $\frac{1}{3}$, subdorsal rather shorter than half median, ending equally with it ; a broad orange postmedian transverse band, margined anteriorly by a vertical violet-golden-metallic fascia followed above middle by ablack dot, and posteriorly by an oblique violet-golden-metallic fascia preceded by a few black scales and interrupted above middle by a short linear orange projection ; a very short white dash midway between band and apex ; a white dash in apical cilia, marked also on undersurface: cilia dark fuscous, with a white costal spot on posterior fascia. Hindwings and cilia dark fuscous.

Khasis, from May to September; ten specimens. Differs from all others by the exceptionally enlarged anal valves of ♂, which are not conspicuous in any other species; distinguished also from all the nearly allied species by the combination of median line reaching base, and apical line reduced to a short white dash.

Cosmopteryx artemidora, n. sp.

♂. 8—9 mm. Head dark shining bronze, crown with three fine violet-white lines, face silvery. Palpi white lined with black. Antennæ blackish, lined with white, four apical joints white, then five black, one white, one black, two white. Thorax dark shining bronze, with three fine violet-white lines. Abdomen bronzy-fuscous, dorsally tinged with orange, apex whitish-ochreous. Posterior tibiæ blackish, with white median and apical rings, and a silvery ring between these. Forewings narrowly lanceolate, apex narrowly long-produced, caudate; blackish; dorsal edge white towards base; a short fine oblique white subcostal line before $\frac{1}{4}$, and very short fine white median and subdorsal dashes beneath its posterior extremity; a broad orange transverse postmedian band, margined anteriorly by an almost vertical violet-golden-metallic fascia followed above middle by a black dot, and posteriorly by two violet-golden-metallic slightly oblique spots, edged anteriorly with a few black scales, lower considerably anterior but placed so that it would touch upper if produced, orange colour projecting between but not beyond these; a short snow-white line in apical cilia, marked also on undersurface: cilia dark fuscous, with a white costal spot on posterior edge of band. Hindwings and cilia dark fuscous.

N. Coorg, 3,500 feet, in October and November (Newcome); two specimens. Distinguished by the entire absence of the apical line, except in cilia.

Cosmopteryx catharacma, n. sp.

♂♀. 7—8 mm. Head dark shining bronze, crown with three fine white lines, face pale bronzy. Palpi white lined with black. Antennæ blackish, dotted and towards base lined with white, four apical joints white, then five blackish, one white, one blackish, one white. Thorax dark shining bronze, with three fine white lines. Abdomen bronzy-fuscous, dorsally suffused with orange. Posterior tibiæ black with white median and apical rings, and a silvery strongly divided metallic ring between these. Forewings very narrowly lanceolate, apex narrowly long-produced, caudate; dark bronzy-fuscous; dorsal edge silvery-white near base; a transverse series of three very short silvery-white dashes before $\frac{1}{4}$, subcostal oblique; a broad orange transverse postmedian band, margined anteriorly by a vertical violet-golden-metallic fascia, and posteriorly by two violet-golden-metallic transverse spots edged anteriorly with a few black scales, lower spot wholly anterior to upper, so that if produced it would cross wing without touching it, between these an irregular projection of the orange colour extends round lower spot to dorsum; a short silvery-metallic dash midway between band and apex : cilia dark fuscous, with a snow-white dot at apex, marked also on undersurface, and a white costal spot on posterior margin of band. Hindwings dark fuscous ; cilia rather dark fuscous.

Peradeniya, Ceylon, from December to March (Green) ; nine specimens. Specially characterized by the snow-white dot in apical cilia, instead of the spot or line shown by allied species.

Cosmopteryx belonaema, n. sp.

♂. 9—10 mm. Head dark shining bronze, crown with three fine white lines, face lighter bronze. Palpi white, lined with black. Antennæ blackish, dotted and towards base lined with white, four apical joints white, then five blackish, one white, one blackish, one white. Thorax dark shining bronze, with three fine white lines. Abdomen bronzy-fuscous, dorsally partially suffused with orange. Posterior tibiæ black with white median and apical rings, and a silvery-metallic ring between these. Forewings narrowly lanceolate, widest near base, apex narrowly long-produced ; blackish ; dorsal edge white near base ; a transverse series of three short white dashes not reaching $\frac{1}{4}$, subcostal rather oblique, longest, subdorsal shortest ; a broad orange transverse postmedian band, margined anteriorly by a vertical violet-golden-metallic fascia and posteriorly by two violet-golden-metallic vertical-transverse spots edged anteriorly with black, lower spot wholly anterior to upper and not meeting it if produced ; between these a short acute-triangular orange projection not reaching beyond upper spot ; a short pale violet-golden-metallic dash midway between this and apex, and another at apex, with a white dash in apical cilia : cilia dark fuscous, with a costal white spot on posterior edge of band. Hindwings dark fuscous ; cilia rather dark fuscous.

Khasis, from March to May ; three specimens. Larger than *catharaema*, with the subcostal line longer, the orange colour not surrounding lower metallic spot, a metallic dash in apex, and a white dash in cilia instead of the dot.

Cosmopteryx basilisca, n. sp.

♂. 8 mm. Head dark shining bronze, crown with three fine white lines, face lighter bronze. Palpi white lined with black. Antennæ blackish, dotted and towards base lined with white, four apical joints white, then five blackish, one white, one blackish, two white. Thorax dark bronze, with three fine whit lines. Abdomen bronzy-fuscous, dorsally tinged with orange, apex whitish. Posterior tibiæ blackish, with white median and apical and silvery subapical rings. Forewings narrowly lanceolate, apex narrowly long-produced ; dark fuscous ; dorsal edge white towards base ; a transverse series of three short white dashes before $\frac{1}{4}$, subcostal rather oblique, subdorsal shortest ; costal edge white for a short space before band ; a broad orange transverse postmedian band margined anteriorly by a vertical violet-golden-metallic fascia, and posteriorly by two violet-golden-metallic vertical-transverse spots, lower spot wholly anterior to upper ; between these a short fine orange line runs to termen, and from close beyond this a fine silvery-white line to apex : cilia dark fuscous, with a white costal spot on posterior margin of band. Hindwings dark fuscous; cilia rather dark fuscous.

Puttalam, Ceylon, in November (Pole); one specimen. Amongst the orange banded species with lower metallic spot wholly anterior to upper it is characterised by the arrangement of the white basal streaks, the white costal edge before band, and the almost entire white apical line.

Cosmopteryx paltophanes, n. sp.

♂. 11 mm. Head dark bronzy-fuscous, crown with three fine white lines, face pale bronzy. Palpi white lined with black. Antennæ blackish, towards base lined with white, four apical joints white, then five blackish, one white one blackish, one white. Thorax dark fuscous, with three fine silvery-white lines. (Abdomen broken.) Posterior tibiæ blackish, with white median and apical rings, and a silvery-metallic ring between these. Forewings narrowly lanceolate, apex slenderly long-produced, caudate; blackish-fuscous; dorsal edge silvery-white towards base; a silvery subcostal somewhat oblique line from base to beyond ¼; a silvery median line from near base to beyond ⅓; a silvery subdorsal line extending rather beyond median but not nearly reaching base; a broad orange postmedian transverse band, anteriorly edged by a slightly oblique pale golden-metallic fascia followed by a few black scales and above middle by a large black dot, and posteriorly by two pale golden-metallic spots edged with black anteriorly, lower larger and somewhat anterior, between these a rather long and broad orange projection extends to termen, and is continued as a white streak along termen to apex: cilia rather dark fuscous, on costa with a whitish spot on posterior edge of band. Hindwings dark fuscous; cilia rather dark fuscous.

Khasis, in August; one specimen. Differs from the similar group by the long median line, which however does not reach base.

Cosmopteryx mimetis, Meyr.

(*Cosmopteryx mimetis*, Meyr., Proc. Linn. Soc. N. S. Wales, 1897, 339.)

♂ ♀. 8-10 mm. Antennæ with one or two apical joints blackish, then two white, four or five blackish, one white, one blackish, one white. Abdomen dark bronzy-fuscous, sometimes orange-tinged. Forewings dark fuscous; a white oblique subcostal line from base to ¼, and short white median and subdorsal lines, widely remote from base and band; costal edge shortly white before band; a broad postmedian orange band narrowed downwards, margined by pale golden-metallic fasciæ, first followed by a black dot above middle, second edged anteriorly with some blackish scales and interrupted above middle by an orange projection, whence proceeds a more or less slightly interrupted white line to apex, sometimes partially marked with yellow. Hindwings dark fuscous.

Maskeliya and Puttalam, Ceylon, in October, and from January to April (Pole, Green); Nilgiris (Andrewes); also from Kuching, Borneo (Hewitt); described from Eastern Australia, and I have specimens from New Guinea. I have briefly redescribed this species for convenience of comparison; it is at once known from its nearest allies by the dark apical joint of antennæ. A similar Australian species, *C. macrula*, Meyr., which also has the dark tip, has longer white median and subdorsal lines, and orange abdomen.

Cosmopteryx vexillaris, n. sp.

♂. 10 mm. Head dark fuscous, crown with three fine white lines, face bronzy-whitish. Palpi white lined with black. Antennæ dark fuscous, towards base lined with white, four apical segments white, then five dark, one white, one dark, two white. Thorax dark fuscous, with three fine white lines. Abdomen dark grey, dorsally mixed with orange-ochreous suffusion. Posterior tibiæ blackish with white median, anteapical and apical rings. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate ; blackish ; dorsal edge white towards base ; an oblique white subcostal line from near base, and a silvery-white median line from base, confluent posteriorly and nearly reaching $\frac{7}{8}$; a white subdorsal line from near base to slightly beyond them ; costal edge white for a short space before band ; a broad orange transverse band somewhat beyond middle, narrowed downwards, anteriorly margined by a slightly oblique pale golden-metallic fascia followed by a black dot above middle, and posteriorly by two golden-metallic spots edged anteriorly with two or three black scales, lower rather anterior, between these is a short narrow orange projection, whence a sinuate white line extends to apex : cilia dark fuscous, with a white costal spot on posterior edge of band. Hindwings dark fuscous ; cilia rather dark fuscous.

Khasis, in October ; one specimen. Specially distinguished by the peculiar disposition of the anterior lines.

Cosmopteryx lætifica, n. sp.

♂♀. 7-10 mm. Head bronzy, crown with three fine white lines, face shining whitish. Palpi whitish lined with blackish. Antennæ blackish, towards base lined with whitish, three apical joints white, then five blackish, then one or two white. Thorax bronzy with three fine white lines. Abdomen ochreous, in ♀ infuscated, apex whitish. Posterior tibiæ white, above greyish-ochreous except at middle and apex. Forewings very narrowly lanceolate, apex very slenderly long-produced, caudate ; ochreous-bronzy ; costal edge white from near base to $\frac{2}{3}$; dorsal edge white towards base ; a fine white subcostal slightly oblique line from base to $\frac{1}{3}$; a fine white median line from base to near band ; a short fine white subdorsal dash beneath posterior extremity of this ; a moderate orange transverse band slightly beyond middle, anterior edge marked with two round golden-metallic spots, upper followed by a large black dot, lower slightly posterior, band posteriorly margined by two golden-metallic spots preceded by a few black scales, upper small, lower large, hardly anterior, between these a suffused elongate orange-yellow projection extends to termen and is continued as a white line along termen to apex : cilia bronzy-whitish, on costa white. Hindwings grey ; cilia bronzy-whitish.

Diyatalawa, Ceylon (Fletcher) ; Nilgiris, 3,500 feet (Andrewes) ; from July to September, seven specimens. Distinct by the ochreous-bronzy ground colour, white costal edge and cilia, and white suffusion of tibiæ.

Cosmopteryx manipularis, n. sp.

♂♀. 10 mm. Head dark fuscous, crown with three fine white lines, face whitish. Palpi white lined with blackish. Antennæ blackish lined with white, three apical joints white, then five blackish, one white, one blackish, one white, three white with fine apical blackish rings, several white. Thorax dark fuscous, with three fine white lines. Abdomen orange, sides and segmental margins fuscous, two apical segments fuscous, margins whitish. Posterior tibiæ blackish with white median and apical rings, and a silvery ring near apex. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate ; dark fuscous ; dorsal edge white towards base ; a fine white somewhat oblique subcostal line from base to $\frac{1}{4}$; a fine white median line not nearly reaching base or band ; a fine white subdorsal line from beneath apex of subcostal to rather near band ; costal edge white for a short distance before band ; a broad ochreous-yellow transverse band beyond middle, anterior edge marked with two pale golden-metallic spots, upper followed by a black dot, lower larger and somewhat posterior, posterior edge marked with two pale golden-metallic spots preceded by some dark fuscous scales, lower larger, hardly anterior, from between these a sinuate yellow streak becoming white on posterior half extends along termen to apex : cilia fuscous, on costa whitish towards posterior edge of band. Hindwings dark grey ; cilia fuscous.

Maskeliya, Ceylon, in May (de Mowbray) ; N. Coorg, 3,500 feet, in October and November (Newcome) : three specimens. This and the two next species have the band yellow, not orange, margined on each side with two golden-metallic spots ; *C. manipularis* is the smallest of the three, and is distinguished by the median line not nearly reaching base.

Cosmopteryx aculeata, n. sp.

♂♀. 12-13 mm. Head rather dark bronzy-fuscous, crown with three fine white lines, face bronzy-whitish. Palpi white lined with dark fuscous. Antennæ blackish lined with white, four apical joints white, then five blackish, one white, one blackish, two white. Thorax rather dark bronzy-fuscous, with three fine white lines. Abdomen light orange, sides and segmental margins pale shining fuscous, last two segments pale fuscous with whitish margins. Posterior tibiæ dark fuscous with white median, anteapical, and apical rings. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate ; rather dark bronzy-fuscous ; dorsal edge white towards base ; a fine white somewhat oblique subcostal line from base to $\frac{1}{3}$; a fine white median line from very near base to near band ; a fine white subdorsal line from beneath apex of subcostal to very near band ; costal edge white for a short space before band ; a broad yellow transverse band beyond middle, narrowed downwards, anterior edge marked with two pale golden-metallic spots, upper followed by a black dot, lower posterior, posterior edge marked with two pale golden-metallic spots preceded by a few black scales, lower larger and slightly anterior, oblique, from between these a sinuate white line, yellow at base, extends along termen to apex : cilia fuscous, on costa whitish on edge of band. Hindwings dark grey cilia fuscous

Maskeliya, Ceylon (Pole); Khasis; Fort Stedman, Burma (Manders); from July to November, and in March; eight specimens. *C. pallifasciella*, Snell, bred from sugarcane in Java, should be nearly allied to this (it is unknown to me), but apparently considerably smaller, with the median line not so long, the metallic anterior margin of band practically entire, and the lower of the two posterior spots slightly beyond the upper (according to the figure).

Cosmopteryx spiculata, n. sp.

♂. 11 mm. Head rather dark bronzy-fuscous, with a fine white line on each side of crown, face bronzy-whitish. Palpi white lined with blackish. Antennæ blackish lined with white, three apical joints white, then three blackish, one black, one white, one black. Thorax rather dark bronzy-fuscous, with three very fine white lines. Abdomen pale bronzy-grey, scutellum and sides silvery-shining, apex whitish. Posterior tibiæ dark fuscous with white median, anteapical, and apical rings. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate; rather dark bronzy-fuscous; dorsal edge white towards base; a very fine white somewhat oblique subcostal line from base to $\frac{1}{4}$; a very fine white median line from very near base to $\frac{1}{3}$; a very fine white subdorsal line from beyond apex of subcostal to rather near band; costal edge white for some distance before band; a broad yellow transverse band beyond middle narrowed downwards, anterior edge marked with two pale golden-metallic spots, upper followed by a black dot, lower posterior, posterior edge marked with two pale golden-metallic spots preceded by a few blackish scales, lower larger and slightly anterior, oblique, from between these a sinuate yellow line becoming white on posterior half extends along termen to apex: cilia whitish-fuscous tinged with ochreous, on costa whitish on edge of band. Hindwings grey; cilia pale bronzy-grey.

Maskeliya, Ceylon, in July (Pole); one specimen. Very like *aculeata*, but distinguished by the differently coloured abdomen, the extreme fineness of the antemedian lines (finer than in any other species), which are also shorter posteriorly, the yellower apical streak, and lighter grey hindwings.

Cosmopteryx hamifera, n. sp.

♂. 8 mm. Head rather dark bronzy-fuscous, with a fine white line above each eye, face whitish. Palpi whitish lined with dark fuscous. Antennæ dark fuscous lined with white towards base, three apical joints white, then two dark fuscous, one white. Thorax rather dark bronzy-fuscous, patagia whitish except shoulders. Abdomen pale ochreous suffused with fuscous, apex whitish. Posterior tibiæ dark, fuscous, with white median, anteapical, and apical rings. Forewings narrowly lanceolate, apex long-produced, caudate; rather dark fuscous; costal edge white from near base to $\frac{3}{4}$; a fine white subcostal line from base to $\frac{1}{4}$; a white median line from base to band; a white subdorsal line from $\frac{1}{4}$ to band, where it joins apex of median; a broad light yellow transverse band extending from middle of wing to $\frac{4}{5}$, anterior edge marked with two rounded pale golden-metallic spots, upper followed by a well-marked black dot, lower directly beneath upper, band crossed beyond its middle by a transverse silvery-whitish fascia; a silvery-whitish streak from band along termen to apex: cilia pale whitish-bronzy, on costa white. Hindwings grey; cilia pale whitish bronzy.

Ceylon (probably low country); one specimen.

Cosmopteryx artifica, n. sp.

♂. 8 mm. Head dark bronzy-fuscous, with a fine white line above each eye, face bronzy-whitish. Palpi white lined with blackish. Antennæ whitish lined with dark fuscous towards base, four apical joints whitish, then five dark fuscous, one white, one dark. Thorax blackish, patagia each with two white lines. Abdomen ochreous-orange dorsally, sides and last two segments fuscous-whitish. Posterior tibiæ dark fuscous, with white median, anteapical, and apical rings. Forewings narrowly lanceolate, apex very slenderly long-produced, caudate; blackish-fuscous; costal edge white from base to band; a fine white slightly oblique subcostal line from base to near $\frac{1}{3}$; fine white lines above and below fold from base to band; a broad light ochreous-yellow transverse band extending from before middle to $\frac{3}{4}$, anterior edge marked with two pale golden-metallic almost confluent spots followed by black dots, lower rather posterior, the band divided into two by a transverse undefined pale golden-metallic fascia beyond its middle; a white sinuate line along termen from band to apex: cilia pale whitish-bronzy, on costa becoming white anteriorly. Hindwings pale bronzy-grey, more whitish towards base; cilia pale whitish-bronzy.

Diyatalawa, Ceylon, in August (Fletcher); one specimen.

Cosmopteryx ingeniosa, n. sp.

♂♀. 12-13 mm. Head dark shining bronze, with a fine white line above each eye, face whitish. Palpi white lined with dark fuscous. Antennæ whitish, towards base lined with dark fuscous, three apical joints white, then five dark fuscous, one white, five white with dark fuscous apical rings. Thorax dark brown, patagia white except shoulders. Abdomen whitish-ochreous, dorsally orange except on segmental margins. Posterior tibiæ dark fuscous, with white median, anteapical, and apical rings. Forewings narrowly lanceolate, apex very slenderly long-produced, caudate; rather dark bronzy-fuscous; costal edge white throughout; a fine white line out of this near base, continued obliquely beneath costa to near band; white median and subdorsal lines running from base to band, between these a very fine pale yellowish line of equal length; a broad yellow transverse band slightly beyond middle, anterior edge marked with two round golden-metallic spots, upper followed by a black dot, lower slightly posterior, band edged posteriorly by a golden-metallic transverse line, interrupted in middle, beyond which however a triangular yellow projection extends and is continued as a strong white sinuate line to apex: cilia whitish ochreous tinged with fuscous. Hindwings grey: cilia whitish-ochreous tinged with fuscous.

Khasis, in September: four specimens.

Persicoptila chiasta, n. sp.

♂. 16 mm. Head whitish with a fuscous mark on each side of crown, face white. Palpi white, extreme apex of second joint grey, terminal joint with two fine indistinct grey rings. Antennæ ochreous-whitish, beneath dotted with dark fuscous. Thorax light fuscous, with margins of patagia and a dorsal line white. Abdomen light ochreous-yellowish, towards apex white, on sides marked with blackish, beneath white. Posterior legs white banded with pale greyish-ochreous, tibiæ with very large expanded brush of light crimson-rosy scales mixed with dark fuscous. Forewings very narrowly lanceolate, widest near base and gradually narrowed to acute apex ; fuscous suffused with dull crimson ; a narrow very oblique white facia beyond middle, and a transverse rather inwards-oblique white line near apex, space between these pale brownish faintly tinged with crimson, in disc at $\frac{2}{3}$ with two or three dark fuscous scales surrounded by indistinct white suffusion ; apical area darker fuscous, with a white apical dot ; cilia pale brownish, with some scattered black points near base, at apex with a dark fuscous median line followed by a whitish spot. Hindwings rather dark grey ; cilia pale ochreous.

Ohiya, Ceylon, 6,000 feet, in August (Fletcher) ; one specimen.

ETHMIADAE.

I accept the suggestion of Mr. A. Busck that this is a good and distinct family, separable from its nearest allies by the origin of vein 5 of hindwings, which is associated in direction with 6 and 7 instead of with 3 and 4. The two following genera are certainly referable to it, they differ from *Echmia* in having 7 and 8 of forewings separate, but agree in all essential characters.

Aetherastis, n. g.

Head with appressed scales ; ocelli small ; tongue developed. Antennæ $\frac{4}{5}$, basal joint large, with strong pecten of dense scales. Labial palpi moderate, ascending, slender, second joint loosely scaled, terminal joint shorter than second, pointed. Maxillery palpi very short, loosely scaled, appressed to tongue. Posterior tibiæ clothed with long rough hairs. Forewings with 2 from $\frac{5}{6}$, 3 and 4 long-stalked, 5 approximated, 7 to costa, 10 from near end of cell, 11 absent. Hindwings 1, elongate-ovate, cilia $\frac{1}{2}$; 3 and 4 stalked, 5-7 somewhat approximated towards base.

Allied to *Comocritis*, from which it differs by the stalking of 3 and 4 of forewings, and absence of vein 11.

Aetherastis uranias, n. sp.

♀. 28 mm. Head, palpi, and antennæ ochreous white. Thorax ochreous white, with four black spots arranged in a diamond on back, and two others on patagia. Abdomen whitish ochreous. Forewings elongate, moderate, costa moderately arched, apex rounded-obtuse, termen obliquely rounded ; white closely speckled with black and suffused with bright pale blue except along costal edge and at base ; black basal dots on costa and in middle ; two small round black spots near base, *viz.*, median and subdorsal, and three others near beyond these, *viz.*, subcostal, median, and subdorsal : cilia blue white, basal third light ochreous yellow. Hindwings pale grey tinged with whitish ; cilia as in forewings.

Peradeniya, Ceylon, in March (Green): one specimen. A curious insect of exceptional colouring.

Comocritis thespias, n. sp.

♂. 34 mm. Head, palpi, and thorax white. Antennæ whitish-ochreous. Abdomen pale grey, anal tuft whitish. Forewings elongate, costa moderately arched, apex obtuse, termen obliquely rounded; pale greyish ochreous: a white basal fascia, leaving a small spot of ground colour on base of costa: a small white dorsal spot close beyond fascia; a thick white streak along costa from fascia to $\frac{3}{5}$: an oblong yellow-ochreous patch extending through lower part of disc almost from basal fascia, terminated by a crescentic white mark in disc at $\frac{2}{3}$, and a quadrate white tornal spot connected with it, ground colour above and below this patch suffused with black irroration; an irregular white streak from $\frac{4}{5}$ of costa to middle of termen, with a projection inwards from near upper extremity, space between this and preceding white markings suffused with black and irrorated with white; apical area yellow-ochreous tinged with fuscous: cilia white. Hindwings dark grey: cilia grey, at apex with a white patch.

Kandy, Ceylon, in October (Green); one specimen. Very similar to *C. olympia*, but easily distinguished by the ochreous apex of forewings, absence of black lines on veins in ochreous discal patch, and other details.

PLUTELLIDAE.

Phycodes taonopa, n. sp.

♀. 20 mm. Head dark fuscous, face brilliant deep prismatic green-blue. Palpi white, towards apex black. Antennæ dark purple fuscous. Thorax dark bronzy fuscous, beneath pearly white. Abdomen dark fuscous, beneath with broad pearl white bands attenuated laterally. Forewings elongate, rather narrow, posteriorly dilated, costa slightly arched, apex obtuse, termen hardly rounded, somewhat oblique; 6 and 7 stalked; dark bronzy fuscous; basal area slightly sprinkled with whitish; a blackish fuscous transverse line at $\frac{2}{5}$ terminating in a semi-circular dorsal blotch, edged anteriorly by a streak of white irroration, and posteriorly by a broad fascia of white irroration, indistinctly double and narrowed towards costa; a small white mark on costa at $\frac{3}{5}$, whence an undefined streak of whitish irroration proceeds outwards beneath costa and again inwards to disc at $\frac{2}{3}$ and thence to dorsum before tornus: cilia dark fuscous, with a few whitish specks. Hindwings blackish fuscous; an ochreous yellow streak beneath vein 1*b*. from base to beyond middle; an elongate ochreous yellow blotch in disc above middle, extending from $\frac{1}{4}$ to $\frac{2}{3}$; cilia pale yellowish with a blackish basal line, at apex suffused with dark fuscous.

Khasis, in October; one specimen. This distinct species differs from the rest of the genus in the stalking of veins 6 and 7 of forewings, but is so obviously allied in all other characters that it is unnecessary to separate it generically; moreover in one example of *P. chionardis* these two veins are connected in middle in one wing, showing variability in this direction.

Phycodes chionardis, n. sp.

♂♀. 17-18 mm. Head dark shining bronzy fuscous with violet reflections, collar and posterbital scales white. Palpi white, terminal joint minute, black. Antennæ dark fuscous. Thorax dark fuscous, scales finely edged with whitish. Abdomen blackish, segmental margins white, beneath much more broadly. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen nearly straight, somewhat oblique; dark purplish fuscous, finely irrorated with white; the coalescence of this irroration seems to form three undefined transverse lines before middle separated by dark lines, and there is a rather large undefined dark costal spot beyond these: cilia deep coppery-purplish. Hindwings blackish fuscous; a narrow white median streak from rather near base to middle hairs of 1*b* white; cilia white, with a blackish fuscous basal line, round apex tinged with coppery-purplish.

Polgahawela and Rambukkana, Ceylon, in May and June (Alston); one specimen.

Phycodes chalcocrossa, n. sp.

♀. 20 mm. Head bright brassy-metallic, back of crown and a line between antennæ dark fuscous, collar whitish. Palpi white, terminal joint very short, black. Antennæ blackish. Thorax fuscous, all scales margined and some centred with whitish. Abdomen fuscous, segmental margins white, beneath much more broadly. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen slightly rounded, somewhat oblique; dark purplish fuscous, on basal area with all scales edged and some streaked with whitish, elsewhere very densely irrorated with whitish, on median area forming fine transverse striæ; a slender dark fuscous transverse fascia at $\frac{2}{5}$, only minutely speckled with whitish; two very small dark fuscous spots on costa beyond this, and several more or less marked minute dark strigulæ before and between these markings: cilia bright coppery-bronze, above apex whitish. Hindwings blackish-fuscous; a cloudy median streak of whitish suffusion extending from near base to middle; hairs of 1*b* whitish; cilia fuscous with a dark fuscous basalline, outer half white except round apex.

Arabia; three specimens received from Standinger and Bang-Haas, by whom the species has been distributed erroneously as *minor* Moore, and recorded as such in Standinger's European Catalogue; it is quite distinct from *minor* by the larger size, bright coppery cilia, white streak in hindwings, bright brassy head, and other characters; hence I thought it best to stop the confusion by describing it here, as it may very possibly be found to occur in India also.

Phycodes cymineuta, n. sp.

♂. 15 mm. Head and thorax blackish finely irrorated with whitish, face metallic blue-greenish. Palpi white, terminal joint short, black. Antennæ blackish. Abdomen dark grey, beneath white. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen nearly straight, somewhat oblique; dark purplish-fuscous, finely irrorated with white specks, which on anterior half are combined into fine white transverse striæ; the absence of these striæ produces a slender dark transverse fascia at $\frac{2}{5}$, four undefined dark dots on costa before this and one beyond it; terminal area with purplish-coppery reflections: cilia fuscous, slightly coppery-tinged, with a few whitish specks near base. Hindwings blackish-fuscous, somewhat lighter towards base; cilia white with a blackish basal line, at apex with a fuscous patch.

Haputale, Ceylon, in June (Alston); one specimen.

Imma loxopis, n. sp.

♀. 30 mm. Head orange, crown dark fuscous except on margins. Palpi orange, upper $\frac{2}{3}$ of second joint anteriorly dark fuscous, terminal joint minute. Antennæ dark fuscous. Thorax dark fuscous, a line on each side of back and margins of patagia orange. Abdomen orange, base of segments broadly blackish. Forewings elongate, moderate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked; dark purplish-fuscous; a narrow irregular orange basal fascia enclosing two small dark fuscous spots; from this fascia rise seven longitudinal yellow-whitish lines on veins and dorsum, reaching mostly to about middle; an oblique transverse rather narrow ochreous-white blotch in disc beyond middle: cilia dark fuscous. Hindwings dark fuscous; a slight orange median dash near base; an orange subdorsal streak from near base to beyond middle; cilia dark fuscous, with a white apical patch.

Khasis, in July; one specimen. Allied to *cælestis*, Meyr., from China.

Iridostoma, n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ $\frac{1}{2}$ basal joint moderate, without pecten. Labial palpi long, recurved second joint somewhat loosely scaled, terminal joint transversely compressed, acute, as long as second. Maxillary palpi obsolete. Middle tibiæ with tufts of long projecting bristles above in middle and at apex, posterior tibiæ with appressed scales slightly roughened above, basal joint of tarsi rough-scaled above. Forewings with 1*b* furcate, 2 from $\frac{4}{5}$, 3 from before angle, 4 from angle, 7 to ápex, 11 from middle. Hindwings over 1, ovate, cilia $\frac{1}{4}$; 3 and 4 approximated at base, 5 parallel, 6 and 7 slightly approximated towards base.

Allied to *hilarographa*, of which it appears to be a development.

Iridostoma ichthyopa, n. sp.

♀. 12 mm. Head dark fuscous, sides of crown and a central line pale yellowish, face grey, becoming whitish beneath. Palpi violet-whitish becoming blue-grey towards apex of second joint, terminal joint dark grey with whitish lateral lines. Antennæ dark fuscous. Thorax dark fuscous, shoulders suffused with yellowish, margins of patagia leaden-grey. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen somewhat sinuate, rather oblique; dark fuscous; a narrow ochreous-orange streak along fold from base to $\frac{2}{5}$, and a violet dark-edged streak above it extending to middle, margined above by an ochreous-yellow streak, four ochreous-yellow streaks from dorsum terminating in posterior portion of this violet streak, first incurved ; two oblique violet streaks from costa at $\frac{1}{3}$ and $\frac{1}{2}$ curved at extremities so as to meet in middle of disc, enclosing an ochreous-yellow dot above the loop : two violet lines rising together from a white dot on costa at $\frac{3}{5}$ and running to dorsum posteriorly, first nearly straight, second strongly curved outwards in disc so as to enclose a space in which are two longitudinal ochreous-yellow marks ; a rather curved violet line from a white dot on costa at $\frac{4}{5}$ to dorsum before tornus ; a narrow fulvous-yellow fascia round apex and along termen to tornus, enclosing a series of seven black dots, of which the uppermost is large and subtriangular, the second blue-centred : cilia violet, tips coppery on lower part of termen. Hindwings dark fuscous, cilia whitish-grey, with a dark fuscous basal line, tips pale violet.

Peradeniya, Ceylon, in April (Green) ; one specimen.

Hilarographa hermatodes, n. sp.

♀. 17 mm. Head golden-yellowish. Palpi yellowish, second joint with a fuscous median band. Antennæ fuscous. Thorax bronzy-fuscous, patagia orange-red edged with leaden-grey. Abdomen pale ochreous mixed with fuscous. Forewings elongate, posteriorly dilated, costa slightly arched, apex rounded-obtuse, termen hardly oblique, rather deeply sinuate beneath apex : 7 and 8 separate ; very deep reddish-orange ; markings dark leaden, costal edge between them yellow ; supramedian, plical, subdorsal, and dorsal streaks from base, all except dorsal terminated in an incurved transverse streak from dorsum before middle, not reaching beyond uppermost, dorsal extended further, base yellowish between them ; six streaks from costa, first three rather broad, first from near base, first two abruptly angulated round apex of supramedian streak and continued as incurved lines to near dorsum where they unite, third receiving above middle five similar paralleled lines from dorsum, the first of which is dilated on fold and contains two dots of ground colour, fourth and fifth costal streaks approximated and continued as a single sinuate blackish line to tornus, sixth light blue and recurved to a yellow dot on costa close before apex, inside this loop is a yellow wedgeshaped costal mark ; four blackish dots near termen on lower half ; a violet-blue mark along termen below middle, its terminal edge finely pale yellow : cilia shining leaden-grey, with a blackish basal line, and a whitish spot on subapical sinuation. Hindwings reddish-fulvous suffused with fuscous, with a broad dark fuscous terminal and dorsal band, leaving terminal edge fulvous round apex and upper half of termen ; a suffused elongate patch of orange-yellowish in middle of disc ; cilia orange-yellowish, with a blackish basal line, round apex infuscated.

Kandy, Ceylon, in May (Green, Alston) ; two specimens.

Hilarographa merinthias, n. sp.

♂. 18-20 mm. Head orange. Palpi light orange, towards base violet-whitish anteriorly. Antennæ dark fuscous, strongly ciliated. Thorax orange-fulvous more or less suffused with fuscous, longitudinally striped with leaden-grey. Abdomen leaden-grey mixed with dark fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique, distinctly sinuate beneath apex; 7 and 8 separate; orange-fulvous; bluish-leaden costal, median, subdorsal, and dorsal streaks from base, costal soon leaving costa, all four terminated in a rather oblique blackish streak from ⅓ of dorsum reaching ¾ across wing; five oblique leaden-bluish streaks edged with blackish lines and rising from whitish dots on costa between ¼ and apex, reaching about ⅓ across wing, second shorter, third very short, but dark margins of both as long as the rest; dorsal area from transverse streak at ⅓ to tornus crossed by about eight rather oblique curved variably confluent and anastomosing blackish streaks reaching almost to costal streaks; a small leaden-metallic spot on termen below middle, with large black dots above and below it; a spot of orange-yellow suffusion at apex: cilia rather dark fuscous, with blackish-leaden basal line. Hindwings blackish-fuscous; an elongate-triangular orange-yellow patch in middle of disc, sometimes suffused with ground colour and indistinct.

Khasis; two specimens.

Hilarographa mechanica, n. sp.

♂. 18 mm. Head dark bronzy, side tufts and postorbital scales golden-yellowish. Palpi whitish, with strong violet-blue reflections. Antennæ dark fuscous, strongly ciliated. Thorax dark violet-fuscous, with orange yellow lateral stripes. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex rounded, termen little oblique, hardly perceptibly sinuate; 7 and 8 separate; orange-fulvous, deeper and brighter towards costa and termen; costal edge dotted with whitish between the dark streaks; six pairs of oblique blackish streaks from costa, reaching ⅓ across wing, last five enclosing light grey-blue streaks, sixth less oblique and whitish towards costa, anterior margin of fourth extended as a blackish line, right-angled in middle, to tornus; whole dorsal area from base to this line crossed by twelve curved oblique dark fuscous lines extending almost to costal streaks, and united above so as to form two or three longitudinal lines, fifth and eleventh of the alternating lines of ground colour blue-whitish; lower half of angulated black line edged by five small indistinct fuscous spots suffused with blue, beyond which is a series of three black dots, two upper very small, lowest large; apical margin suffused with yellow; a leaden-blue mark on termen beneath apex, almost connected with tips of fifth and sixth costal streaks, and a leaden-blue line along lower part of termen, its upper extremity bent away and followed by some black scales; cilia violet-fuscous, with a dark fuscous basal line, round apex and at tornus with patches of whitish suffusion, and a whitish spot on subapical mark. Hindwings dark fuscous, with an elongate-triangular ochreous-yellow spot in middle of disc; cilia whitish with dark fuscous basal line.

Khasis, in July; one specimen.

Hilarographa calathisca, n. sp.

♀. 10 mm. Head dark bronze, behind eyes light orange-ochreous. Palpi whitish, with strong violet reflections. Antennæ dark fuscous. Thorax dark fuscous, lateral margins light ochreous. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa slightly arched, apex rounded, termen rather obliquely rounded; 7 and 8 separate; orange-fulvous; six pairs of oblique blackish streaks from costa crossing ⅖ of wing, enclosing light violet-blue streaks rising from small yellow spots, fourth pair without blue streak and with its posterior member reduced to a costal spot, sixth bent to termen beneath apex, enclosed apical spot suffused with yellow; dorsal ⅗ from base to near tornus crossed by six oblique blackish streaks, first broad, next two slender, fourth and fifth thick and largely confluent, sixth running into an erect light violet-blue streak from dorsum before tornus, reaching half across wing; a shorter transverse light violet-blue streak from termen above tornus, its lower extremity preceded and upper followed by small black spots: cilia bronzy-grey, partially tinged with coppery-orange, with a blackish basal line, about apex and on a subapical spot whitish-grey. Hindwings dark fuscous; cilia grey with dark fuscous basal line.

Khasis, in May; one specimen.

Hilarographa citharistis, n. sp.

♂♀. 13-15 mm. Head ochreous-brown. Palpi whitish, with strong violet reflections. Antennæ dark fuscous, in ♂ simple. Thorax and abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen rather obliquely rounded, sinuate beneath apex; 7 and 8 separate; orange fulvous; markings light blue strongly edged with black on costal edge whitish and more strongly black-margined; four acutely angulated transverse streaks on anterior half, first two subconfluent, third and fourth connected on angle; three streaks from costa on posterior half, third longer and curved to near apex, from beneath first two a band of irregular variable suffused and anastomosing black marks runs to dorsum beyond middle; two transverse streaks from dorsum before tornus, first reaching half across wing, second shorter; a curved series of four large black dots or small spots beyond these; an upward streak from termen below middle, followed by a large black dot; a short longitudinal subapical mark, white on termen: cilia dark fuscous with a blackish basal line, above apex with a white patch on which the blackish line is subbasal, on subapical and submedian streaks with whitish spots. Hindwings dark fuscous, sometimes lighter and bronzy-tinged in middle of disc; extreme apex tinged with fulvous; cilia light fuscous, with dark fuscous basal line.

Khasis, from July to September; eleven specimens. The simple ♂ antennæ are exceptional.

Hilarographa druidica, n. sp.

♂♀. 13-15 mm. Head dark fuscous, orbital margins yellow. Palpi fuscous, towards base anteriorly violet-whitish. Antennæ dark fuscous, in ♂ strongly ciliated. Thorax dark fuscous, with a yellow stripe on each side of back, and a short yellow lateral mark on patagia. Abdomen dark fuscous. Forewings elongate-triangular, costa gently arched, apex rounded, termen rather oblique, sinuate beneath apex ; 7 and 8 separate ; orange-fulvous ; a blackish basal patch, its outer edge sharply angulated above middle, and margined on upper portion by a violet black edged streak becoming yellow on costa, on lower portion by broad yellow streak attenuated at apex and strongly black-edged posteriorly ; within this patch are a curved yellow streak from base of costa to disc and thence to near posterior edge above angle and a short yellow mark from costa near base ; two oblique violet black-edged streaks starting from white marks on costa before and beyond middle, and connected by three irregularly anastomosing black streaks with dorsum beyond middle ; a violet black-edged streak rising from a white dot on costa at $\frac{3}{4}$, and curved round to meet an oblique white mark from costa near apex ; a violet-golden-metallic transverse streak from dorsum before tornus reaching half across wing and another along lower half of termen, former nearly followed by a fine black line, latter preceded by four small black spots and surmounted by another ; a white terminal dot beneath apex : cilia dark coppery-metallic, above apex white with a black basal line, and with a white spot on subapical dot. Hindwings blackish-grey, sometimes paler and slightly bronzy-tinged in middle of disc ; cilia pale grey, with a blackish basal line.

Khasis, in May and from August to October : seven specimens. Nearly allied to *H. africana*. Wals from Central Africa.

Glyphipteryx asterias, Meyr.

(*Anticrates asterias*, Meyr. Journal Bombay N. H. Soc., XVIII, 154.)

Having obtained additional material, I find this to be a true *Glyphipteryx* having the typical palpi (which were in bad condition in the type), with four oblique white rings ; it is however a very distinct form of the genus.

Glyphipteryx pyrogastra, n. sp.

♂ ♀. 15-16 mm. Head, antennæ, and thorax purple-blackish, face grey. Palpi black lined with white, terminal joint much longer than second. Abdomen fiery orange towards base purple-blackish. Forewing elongate, narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen rather strongly oblique, sinuate-indented beneath apex ; 7 and 8 separate ; purple-blackish ; six blue-leaden metallic lines rising from white costal strigulæ, first at $\frac{1}{3}$, short, second at $\frac{1}{2}$, oblique, reaching half across wing, third rather curved, running to dorsum near tornus, fourth and fifth short, sixth violet-tinged running to subapical indentation ; a violet-metallic sometimes interrupted line almost on termen from beneath this to near tornus, and a dot at tornus : cilia bronzy-whitish with a blackish median line, interrupted with white on subapical indentation. Hindwings dark grey, towards apex blackish-grey ; cilia whitish-grey suffused with dark grey towards base.

Khasis, in August and September ; two specimens.

Glyphipteryx hemipempta, n. sp.

♂ ♀. 7-9 mm. Head and thorax bronzy. Palpi white, with four rings and anterior edge towards apex black. Antennæ fuscous. Abdomen dark fuscous, in ♀ with expansible lateral tuft of scales before apex, and expansible scales at apex. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen somewhat sinuate, oblique ; 7 and 8 separate ; all scales bronzy-yellowish with dark fuscous bases, appearing to form fine transverse striæ, but becoming bronzy-whitish towards base and on a broad discal patch above tornus ; six bluish-leaden-metallic streaks rising from whitish marks on costa, first before $\frac{1}{3}$, somewhat oblique, reaching half across wing, second and third direct, parallel, running to dorsum, fourth very short, fifth running to subapical indentation, sixth close before apex ; three round adjacent black spots on lower part of termen, each containing a golden-metallic dot ; veins on pale area above these marked with fine black lines, and some short interneural black dashes posteriorly : cilia whitish, basal third pale bronzy, indented with white beneath apex. Hindwings dark fuscous ; cilia pale grey, suffused with dark grey towards base.

N. Coorg, 3,500 feet, in October and April (Newcome) ; Maskeliya, Ceylon, in January (Pole) ; seven specimens.

Glyphipteryx enclitica, n. sp.

♂ ♀. 10-12 mm. Head, antennæ, and thorax rather dark bronzy-fuscous. Palpi fuscous; internally whitish. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen rather deeply sinuate beneath apex, oblique ; 7 and 8 separate ; golden-ochreous-bronze ; straight thick converging violet-metallic streaks, edged with dark fuscous, from costa at $\frac{1}{4}$ and $\frac{3}{5}$ to dorsum at $\frac{1}{2}$ and $\frac{3}{4}$, and a similar transverse streak from costa between these not reaching half across wing ; an irregular subtriangular black blotch extending along lower portion of termen, its anterior edge excavated, containing about sixteen violet-golden-metallic dots and specks ; area between this and costa crossed by fine black lines on veins and less marked blackish interneural lines ; a violet-blue-metallic streak from $\frac{5}{6}$ of costa to subapical sinuation ; a white wedge-shaped marked on costa before apex, becoming blue metallic at extremity : cilia bronzy, with a black median line indented with white on subapical sinuation, outer half whitish-grey, above apex fuscous. Hindwings dark fuscous ; cilia grey.

N. Coorg, 3,500 feet, in May, August and September (Newcome) ; four specimens.

Glyphipteryx hilarodes, n. sp.

♀. 10 mm. Head pale ochreous-yellowish with a central bronzy-fuscous stripe, back of crown dark fuscous. Palpi yellowish-white, with a dark fuscous anterior line. Antennæ dark fuscous. Thorax dark fuscous, with a yellow stripe on each side of back. (Abdomen broken.) Forewings elongate-triangular, costa gently arched, apex obtuse, termen slightly sinuate beneath apex, rather oblique ; 7 and 8 separate ; blackish ; two pale yellowish strigulæ from costa near base ; a narrow direct yellow fascia at $\frac{1}{5}$; an oblique blue-metallic streak from a white dot on costa beyond $\frac{1}{3}$, and a violet-metallic streak from dorsum beyond middle, between the extremities of these are two orange dots preceded by a blue-metallic dot and followed by a violet-metallic dot above and below the latter are orange dashes, and beneath the lower of these two orange dots ; an angulated violet-metallic streak from a white dot on costa at ⅗ to a yellow dot on dorsum at ¾, interrupted on angle, preceded by an orange streak on upper portion, and closely followed throughout by a curved orange streak becoming orange-fulvous on costal half ; apical area beyond this orange-fulvous, marked with three short violet-metallic anteriorly black-edged streaks from white dots on costa, a suffused black apical spot, and a small violet-metallic subapical spot ; a short violet-metallic mark before tornus, and a longer erect streak beyond it, between these an indistinct orange-fulvous line connects apical area with tornus : cilia whitish, basal half blackish, indented with whitish beneath apex, with a blackish apical hook. Hindwings with 6 and 7 nearly approximated at base ; blackish-fuscous ; cilia dark fuscous, towards tips whitish-grey.

Khasis, in October ; one specimen. This distinct species apparently shows real relationship with *Hilarographa* but is a true *Glyphipteryx.*

Glyphipteryx carenota, n. sp.

♂ ♀. 12-14 mm. Head and antennæ dark bronzy. Palpi whitish-ochreous, anteriorly dark fuscous except towards base. Thorax dark bronzy, with a pale yellow posterior spot. Abdomen dark fuscous, segmental margins partially whitish. Forewings elongate narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen sinuate-indented beneath apex, rather strongly oblique : 7 and 8 separate : dark fuscous bronze ; an acute-triangular pale ochreous-yellow blotch on dorsum before middle, reaching ¾ across wing : an undefined median band of bronzy-orange suffusion, on which are two direct transverse light blue-metallic streaks from whitish dots on costa before and beyond middle, reaching nearly half across wing, and a longer similar streak from dorsum between them ; short similar marks from costa and dorsum near beyond these ; an irregular elongate black blotch along termen from indentation to tornus, containing from eight to ten golden-metallic dots ; area above this blotch obscurely and suffusedly streaked longitudinally with whitish ; a violet-blue-metallic line from a white dot on costa at ⅚ to subapical indentation, preceded and followed by more or less bronzy-orange suffusion ; a violet-blue metallic transverse line almost at apex from a white mark on costa : cilia pale shining bronzy, with a blackish median line indented with white beneath apex, outer half whitish. Hindwings blackish-fuscous ; cilia whitish-grey, suffused with dark grey towards base.

Khasis, in May ; seven specimens.

Glyphipteryx synarma, n. sp.

♂. 12 mm. Differs from *carenota* only as follows : forewings with first costal and dorsal alternating streaks replaced by a straight light blue-metallic entire transverse line, longitudinal whitish streaks more defined.

Khasis, in October ; two specimens ; not in good order, but the species seems to be certainly distinct.

Glyphipteryx crotalotis, n. sp.

♀. 16 mm. Head, antennæ, thorax, and abdomen dark purplish-fuscous. Palpi white, with three black rings and towards apex lined with black, second joint with rough projecting hairs beneath. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen sinuate beneath apex, oblique; 7 and 8 separate; dark fuscous, slightly tinged with bronzy-purplish; a slender direct pearl-white fascia at $\frac{1}{5}$; a slightly oblique pearl-white streak from dorsum beyond middle, reaching fold; six fine short oblique violet-metallic streaks from costa, white on costa, first before middle, third rather longer; violet-metallic dots beneath tips of first and third; a small oblique violet-metallic mark before tornus; two violet-metallic dots before lower portion of termen, one on subapical indentation, and one or two specks in disc before these: cilia fuscous, with a dark fuscous median shade, rather sinuate on subapical indentation. Hindwings blackish, fuscous; cilia fuscous, with dark-fuscous subbasal shade.

Khasis, in July; one specimen.

Glyphipteryx sclerodes, n. sp.

♂♀. 10-14 mm. Head, antennæ, thorax, and abdomen dark bronzy-fuscous. Palpi white, with four rings and anterior edge towards apex black. Forewings elongate, rather narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen somewhat sinuate, rather oblique; 7 and 8 separate; dark fuscous-bronze, veins in disc streaked with blackish; two strong slightly curved white-streaks from dorsum at $\frac{1}{4}$ and beyond middle, reaching fold; seven fine violet-golden-metallic black-edged lines from costa, becoming white towards costa, first five straight, oblique, first at $\frac{1}{3}$, third and fourth longest, reaching about half across wing, sixth and seventh less oblique curved, seventh running to anteapical sinuation; two violet-golden-metallic dots in disc beneath third and fourth; two erect violet-golden-metallic streaks from before and beyond tornus, not reaching half across wing: cilia white, basal third bronzy limited by a black line indented on subapical sinuation, at apex with a black hook. Hindwings dark fuscous; cilia grey, suffused with dark fuscous towards base.

Maskeliya, Patipola, and Horton Plains, Ceylon, in December, January, March, July, and September (Pole, Alston, Fletcher); six specimens. Those from the higher elevations (the two latter localities) are larger and have the dorsal white streaks rather conspicuously broader than the others.

Glyphipteryx bicornis, n. sp.

♂♀. 14-16 mm. Head and thorax fuscous. Palpi white with four black rings, and anterior edge black towards apex, second joint with long rough spreading tuft of mixed white and black hairs beneath. Antennæ blackish dotted with white. Abdomen dark fuscous, segmental margins partially whitish. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen sinuate beneath apex, oblique; 7 and 8 separate; rather dark bronzy-fuscous, apical third more or less suffused with yellow-ochreous; two ochreous-white dorsal spots, first at $\frac{1}{4}$, narrow, fasciaform, oblique, slightly curved, reaching $\frac{2}{3}$ across wing, second at $\frac{2}{3}$, broader, acute triangular, reaching half across wing, terminated above by an oblique violet-metallic mark; seven oblique white strigulæ from costa becoming violet-metallic downwards, first at $\frac{1}{3}$, third longer, reaching half across wing, fourth continued as a rather curved more or less interrupted violet-metallic line to dorsum before tornus; a violet-metallic mark on subapical indentation, and two on lower part of termen: cilia bronzy, with a fine blackish median line indented with white, beneath apex, outer half white, with a dark fuscous apical hook. Hindwings blackish-fuscous; cilia pale grey, suffused with dark grey towards base.

Khasis, in March and April; three specimens. Nearly allied to *sclerodes*, but differing by the tufted palpi, as well as details of markings.

Glyphipteryx psychopa, n. sp.

♂♀. 6-7 mm. Head, palpi, and thorax white. Antennæ whitish-grey. Abdomen light grey, apex whitish. Forewings elongate, narrow at base, posteriorly dilated, costa gently arched, apex obtuse, termen slightly sinuate, very oblique; 7 and 8 separate; pale bronzy-grey, on posterior half pale bronzy-ochreous; a suffused white streak along dorsum from base to first spot; five costal and two dorsal white wedge-shaped marks edged anteriorly by oblique dark fuscous lines, first costal in middle moderately long, second extended as an irregular streak to termen above tornus, last three short, first dorsal beyond middle, long, curved, sometimes much dilated dorsally, second on tornus, erect, moderate; a small white spot on termen beneath apex; a conspicuous round black apical dot: cilia pale bronzy-ochreous, with a blackish median line indented with white beneath apex, outer half whitish. Hindwings lanceolate, grey; cilia pale ochreous-grey.

Diyatalawa, Ceylon, in July and August (Fletcher); seven specimens.

Glyphipteryx maschalis, n. sp.

♂♀. 10 mm. Head and palpi white, crown bronzy-tinged. Antennæ grey, base white. Thorax pale ochreous-bronzy, sides of back suffused with white. Abdomen dark grey, segmental margins whitish. Forewings elongate, narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen somewhat sinuate, rather strongly oblique; 7 and 8 separate; light bronzy-yellowish; base and costa to first streak suffused with bronzy-fuscous; five oblique silvery streaks suffusedly edged with dark fuscous from white spots on costa, first somewhat before middle, reaching half across wing, second somewhat longer, rest short, terminated by a large patch of dark fuscous suffusion resting on termen beneath apex, a dark fuscous patch extending along dorsum from base to prætornal spot, cut by a thick curved oblique, white streak from dorsum before middle, broadly edged with dark fuscous reaching more than half across wing, dilated dorsally; a white semi-oval prætornal spot, above which the dark fuscous dorsal patch forms a projection; an erect silvery streak from tornus, reaching nearly half across wing, its apex connected by a dark fuscous streak with apex of curved white dorsal streak, and posteriorly with subapical dark patch ; two small sometimes confluent bluish-silvery spots on lower part of termen, partially edged with black ; a silvery dot on termen beneath apex : cilia whitish bronzy, with a blackish median line indented with white beneath apex, outer half more whitish, with traces of a blackish apical hook. Hindwing dark fuscous : cilia whitish-fuscous, with a suffused fuscous subbasal shade.

Diyatalawa and Puttalam, Ceylon, in July, August, and November (Fetcber, Pole) ; three specimens.

Glyphipteryx rhodanis, n. sp.

♀. 14-16 mm. Head, antennæ, and thorax bronzy-fuscous. Palpi dark fuscous, with base, three rings, and sides of apex white. Abdomen dark fuscous. Forewings elongate, narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen sinuate, rather strongly oblique ; 7 and 8 separate ; bronzy-fuscous, posterior half ochreous-bronze ; markings prismatic golden-metallic, becoming white on costa, finely edged with blackish ; six short oblique streaks from costa, first in middle, second longest, reaching half across wing ; an upward-oblique streak from fold beneath apex of first costal ; erect streaks from before and beyond tornus, not reaching half across wing ; in a line between first of these and fourth costal are two small spots in disc, followed by a small spot of blackish suffusion ; a small spot on subapical sinuation ; a suffused blackish apical spot : cilia bronzy-whitish with a blackish median line indented on subapical sinuation, and with a blackish apical hook. Hindwings dark fuscous : cilia light ochreous, suffused with fuscous towards base.

Khasis, in May ; two specimens.

Glyphipteryx canachodes, n. sp.

♂. 14 mm. Head blackish-bronze. Palpi white, with four rings and anterior edge towards apex black. Antennæ whitish ringed with blackish. Thorax shining bronze. Abdomen grey, anal tuft grey-whitish. Forewings elongate, rather narrow at base, posteriorly dilated, costa slightly arched, apex obtuse, termen slightly rounded, oblique ; 7 and 8 separate ; golden-bronze ; markings prismatic golden-metallic, on costa whitish ; a streak on fold from near base to $\frac{1}{4}$; six streaks from costa, first at $\frac{1}{3}$, running to dorsum beyond middle, second and third not reaching middle of wing, fourth slightly curved, running to dorsum before tornus, fifth reaching half across wing, sixth running almost along termen to tornus ; a black mark running from middle of disc obliquely downwards to beyond fourth streak, by which it is interrupted, bearing a small round golden-metallic spot near its anterior extremity : cilia whitish-grey, basal third golden-bronze, with a dark fuscous apical hook. Hindwings grey, lighter towards base; cilia pale greyish-ochreous.

Nilgiris, 3,500 feet, in May (Andrewes) ; one specimen. This belongs to the group in which there is no subapical indentation in the median line of cilia, and is nearly related to several Australian species.

Glyphipteryx antidoxa, n. sp.

♂♀. 19-22 mm. Head whitish-ochreous more or less irrorated with dark fuscous. Palpi fuscous-whitish. Antennæ pale greyish-ochreous dotted with dark fuscous. Thorax whitish irrorated with dark fuscous. Abdomen fuscous mixed with dark fuscous, segmental margins whitish. Forewings elongate, rather narrow, slightly dilated posteriorly, costa slightly arched, apex rounded, termen sinuate-indented beneath apex, rather oblique ; 7 and 8 separate ; pale whitish-ochreous finely irrorated with black ; markings cloudy, whitish ; a slender irregular fascia before ⅓, becoming obsolete towards dorsum ; a slightly curved median fascia narrow towards costa, broader and sometimes bifid on dorsal half ; three converging streaks from costa posteriorly, second often obsolete, uniting with an oblique discal streak near before them, a streak along lower part of termen, and a small spot on tornus in a general cloudy suffusion ; two round black terminal dots about apex, and two others below sinuation ; cilia whitish, with a black median line, basal half on tornus speckled with blackish, elsewhere appearing dark fuscous in certain lights. Hindwings dark fuscous ; cilia whitish-fuscous, suffused with fuscous towards base.

N. Coorg, 3,500 feet (Newcome) ; Madulsima, Ceylon (Vaughan) ; in December, and from March to June, six specimens. This is a singular species of novel type.

Glyphipteryx orymagdis, n. sp.

♂. 13 mm. Head and Thorax whitish. Palpi whitish, second joint fuscous except at apex, with long projecting tuft of scales beneath. Antennæ grey. Abdomen light greyish-ochreous. Forewings elongate, rather narrow, widest in middle, costa gently arched, apex round-pointed, termen slightly sinuate extremely oblique ; 7 and 8 separate ; light brownish-ochreous, more infuscated on margins of markings, markings whitish ; about seventeen rather short oblique streaks from costa between ¼ and apex ; a slender median streak from base to ¾ ; a rather broad dorsal streak from base to tornus, attenuated posteriorly ; posterior half of wing longitudinally streaked with whitish between veins, on costal half very confusedly ; some blackish scales on upper margin of median streak posteriorly, and on lower margin of interneural streak beyond it : cilia whitish, with a dark fuscous median line edged with brownish-ochreous posteriorly, and a blackish apical hook. Hindwings narrow, pointed, 3 and 4 stalked ; grey ; cilia whitish-ochreous.

Patipola, Ceylon, in April (Alston) ; one specimen. Allied to some Australian and New Zealand forms.

MICROPTERYGIDÆ.

The interesting species described below is the first member of this primitive family recorded from the Indian region (for Walker's *Micropteryx acutipennis* and *M. unicella* have no real connection with the family, being normal *Tineidæ*), but since the family is characteristic of Europe and New Zealand, I have little doubt that it has been overlooked in India, and will be found to be fairly represented. The species are usually small (the one described below is the largest known), very difficult to see on the wing, and liable to be mistaken for *Trichoptera* (caddis flies), to which in fact they are nearly related. They should be looked for probably in damp but open forests of Conifers at high elevations, especially in the spring.

Neopseustie, n. g.

Head with short loose hairs; ocelli present; tongue short. Antennæ $\frac{3}{4}$ filiform, with appressed hairscales, basal joint moderate. Tabial palpi moderate, porrected, filiform, with appressed scales. Maxillary palpi long, several-jointed filiform, folded. Abdomen stout, swollen posteriorly. Posterior tibiæ with appressed scales, spurs short. Forewings clothed with hairs, but with scattered scales on anterior half; 1*b* connected with lower margin of cell by bar towards base, 1*c* weak, appearing to rise from upper end of this bar, parting-vein connected with lower margin of cell by bar towards base (besides the bar forming posterior wall of cell), 2 and 3 stalked from angle of cell, 4 rising from parting-vein, which itself forms cell-wall for a considerable distance beyond the second bar, 5 and 6 stalked from angle made by parting vein, with bar above it, 7 and 8 stalked from upper angle of cell, 7 to apex, 9 out of stalk of 7 and 8 near base, 10 absent, 11 from rather beyond middle of cell, 12 connected with costa by a bar in middle. Hindwings more rounded than forewings posteriorly, clothed with hairs: 1*b* connected with 1*c* by bar near base, posterior cell-wall normal in form, 2 remote, 3 from angle, 4 from above angle, 5 and 6 stalked, 7 and 8 stalked from upper angle, 9 out of stalk of 7 and 8 near base, 10 absent, 11 from $\frac{2}{3}$ of cell, 12 simple.

Slightly more specialised than the European *Eriscrania*, to which it is most related.

Neopseustis calliglauca, n. sp.

♂. 20 mm. Head pale ochreous, with some dark fuscous hairs. Labial palpi and antennæ light fuscous. Maxillary palpi pale ochreous. Thorax pale brownish-ochreous, with some silvery-white scales. Abdomen light yellow-ochreous, appearing broad and subtruncate posteriorly, with upper and lower lips, upper with sexual organs strongly depressed, lower short. Forewings subovate, moderately broad, costa strongly arched, apex obtuse, termen rounded rather strongly oblique; whitish; a fuscous patch covering anterior portion of wing and extending on costa to near middle and on dorsum to near tornus irregularly marked with blackish-fuscous transverse spots or bars between veins and thinly strewn with fine scattered violet-silvery-white scales, its outer edge irregular and prominent above middle; small brownish-ochreous spots on dorsum at $\frac{3}{4}$ and tornus; posterior area of wing strongly tinged with purple on lower half, and with pale green between this and costal area; at oblique irregular spot on costa at $\frac{3}{5}$, an elongate mark along apical fourth of costa, a large spot on termen beneath apex, and a smaller one below it light fuscous: (cilia defective.) Hindwings light prismatic-grey, posteriorly strongly purple tinged; cilia whitish-grey (defective).

Khasis, in October; one specimen, taken by a native collector. It is an insect of curious appearance, somewhat recalling small *Arctiadæ* of he *Nudaria* or *Chamaita* type.

Synonymic Correction.

Argyroploce mosaica, Low. Trans. Roy. Soc. S. Austr., XXV, 72.

This supersedes *clydonias*, Meyr., Journ. Bomb. N. H. Soc., XVII, 734; Mr. Lower has recently sent me the type for inspection; described from Queensland as type of a supposed new genus *Temnolopha*.

Argyroploce poetica, n. nom.

I propose this name for the species described as *mosaica*, Meyr., Journ. Bomb. N. H. Soc., XVIII, 139, which in consequence of the above change finds its name preoccupied.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

(INCLUDING THOSE MET WITH IN HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

(With Plates F and I)

(Continued from page 58 of this Volume.)

SUB-FAMILY—*SATYRINÆ.*

A. Eyes hairy.

a. Vein 12 of forewing and median vein both swollen at base, with a subapical ocellus; the hindwing not tailed.................................. ..... *Mycalesis.*

b. Vein 12 of forewing only swollen at base, with no subapical ocellus; hindwing with short tail.. *Lethe.*

B. Eyes naked.

a. Vein 12 of forewing not swollen at base........... *Melanitis.*

b. Vein 12 of forewing swollen at base.

a. Upperside forewing with a preapical ocellus: of small size, not exceeding 1·78″ .... *Ypthima.*

b^1. Upperside forewing with no ocellus: uniform: of larger size, never less than 1·75″.

a. Upperside: uniform vandyke-brown to blackish brown: size never exceeding 2·15″...................... .... *Orsotriœna.*

b. Upperside hindwing at least tawny: size never or rarely less than 3″....... .... *Elymnias.*

Genus—MYCALESIS.

A. Forewing upperside with large prominent white ocellus or "eye," the pupil, low down on one side, giving it the appearance of squinting. Exp. 1·75″ to 2·05″...................................... *junonia.*

B. Forewing upperside with an ordinary ocellus.

a. Forewing with the apex acute, not rounded. Exp. 2·05″ to 2·4″....... ....,.......... .... *visala.*

b. Forewing with the apex rounded.

a^1. Hindwing underside: posterior three ocelli only in a straight line. Exp. 1·68″ to 2·1″ (*vide* Fig. 7, B.) .... *perseus.*

b^1. Hindwing underside : posterior four ocelli in a straight line (*vide* Fig. 7, A).

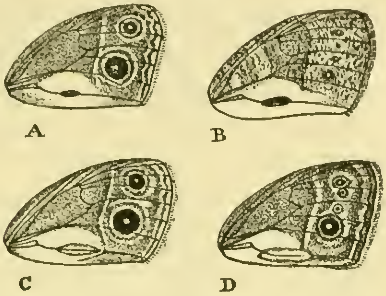


Fig. 6.—Underside forewings of *Mycalesis*, showing secondary sex-mark of specialised scales.
A. *M. perseus*, Fabr. B. *M. polydecta*, Cramer.
C. *M. subdita*, Moore. D. *M. visala*, Moore.

a^2. Forewing underside in male : sex-mark small, under 2mm. in length, black or dark brown in colour. Exp. 1·9″ to 2·2″ (*vide* Fig. 6, B) .. .. *polydecta*.

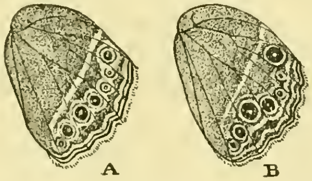


Fig. 7.—Arrangement of ocelli on underside of hindwing in
A. *M. polydecta*, Cramer. B. *M. perseus*, Fabr.

b^2. Forewing underside in male: sex-mark larger, over 4mm., brown, never dark (*vide* Fig. 6).

a^3. The sex-mark not extending to transverse white discal band. Exp. 1·75″ to 2·2″ (*vide* Fig. 6, C) .. .. *perseoides*.

b^3. The sex-mark extending to and touching the inner margin of that band. Exp. 1·9″ to 2·35″ (*vide* Fig. 6, C) .... *subdita*.

The ocellus of the forewing under heads A and B is situated about the centre of the forewing nearer the outer margin than the base. The sex-marks are only found in the males on the underside of the forewing above the inner margin where they are easily seen on the satiny white ground distinguishing that region (*vide* marginal Fig. 6). There is, besides, on the upperside of the hindwing, facing this mark, a conspicuous tuft of long, recumbent hairs, generally white in colour.

As regards the females of the last three species the descriptions will have to be consulted and, even then, they are not easily distinguishable. The size of the ocellus on the upperside of forewing and the more or less light suffusion around it affords no criterion of difference, being very variable in the same species. The wet-season forms have the ocelli on the undersides of the wings very clearly defined, prominent and large; the dry-season forms have them very much reduced in size (*vide* Pl. F, figs. 37 and 37*a*), sometimes mere black or white dots, or even altogether wanting and the ground-colour of the whole wings underneath shaded and variegated, sometimes dark, sometimes light, generally with a dark transverse fascia or line from costa of forewing after middle to the inner margin of hindwing before tornus; in the wet-season the colour of the underside is uniform and dark, the fascia being then sometimes white.

Genus—LETHE.

A. Hindwing underside: basal half brownish-black with a conspicuous pale or purplish transverse straight line (male upperside forewing with two prominent white preapical spots; female with a broad white oblique preapical band). Exp. 2·45″ to 3″.. *europa.*

B. Hindwing underside: basal half mottled and shaded with greyish-brown and purple, no distinct transverse line.

a. Forewing upperside male: uniform in colour without spots; of female: with oblique white discal band. Exp. 2·55″ to 2·7″.................... *drypetis.*

b. Forewing upperside male: with a costal and two preapical white spots and another between veins 2 and 3 with, mostly, a black dot on it: of female: with an oblique white band of three white spots. Exp. 2·5″ to 2·6″............. *nilgiriensis.*

Genus—MELANITIS.

A. Forewing upperside: without, or with comparatively small and narrow markings of ferruginous or ochraceous near apex.

a. The markings bordering a large subapical black spot inwardly and above but not reaching to the costa. Exp. 2·8″ to 3·1″......................... *ismene.*

b. The markings extending to the costa in a short oblique bar.

- a^1. Upperside male: nearly black; upperside female: is brown with ocellus and markings much more distinct than in the dark male, these markings black; underside male: often with chalky spots in dry-season form; underside both sexes in wet season striated like wet-season *ismene*. Exp. 2·75″ ... . *varaha.*
- b^1. Upperside male and female: brown like *ismene*, the black ocellus distinct, the underside resembling that of *ismene* also but the male often with inky markings towards the base of wings, always without white chalky markings. Exp. 2·75″ to 3·1″..................... *gokhala.*

B. Forewing upperside: with a large patch of yellow-orange near apex.

- *a*. Forewing upperside with subapical black spots large, confluent, extending inwards and joining black patch beyond apex of cell. Exp. 3·25″ to 3·5″.. *zitenius.*
- *b*. Forewing upperside with subapical black spots small, rarely wanting, never extended inwards, surrounded by orange patch. Exp. 2·8″ to 3·3″ .... *bethami.*

Of these insects *ismene* is the only one that can be said to belong properly to the Plains of India and it is one of the very commonest of all butterflies throughout the country. *Bethami* is very local, being recorded so far only from Pachmarhi in Central India. *Zitenius* is probably altogether confined to the dense jungles and hills of South India, Sikhim, Assam, &c. The remaining two species are of common occurrence in the bamboo jungles of the West Coast South of Bombay and on the borders of the plains and may occasionally stray into them; *varaha* should certainly occur on the ghats round the town of Bombay and *gokhala* is sure to turn up round Khandala or slightly further South, but not under 1,500 elevation. The larvæ of the last three species are well known and are abundantly distinct; they are coloured green, dark and light in stripes, have two straight horn-like processes on the head and the tail ends in two well separated points. The larva of *gokhala* feeds upon bamboos, of *zitenius* probably also; of *ismene* and *varaha* upon grasses. Seasonal dimorphism is strongly developed in all species.

Genus—YPTHIMA.

A. Hindwing underside: with two subapical ocelli; the ocelli arranged in pairs in échelon. Exp. 1·25″-1·28″ .... *philomela.*
B. Hindwing underside: with one subapical ocellus.
  a. Hindwing underside: with two posterior ocelli, the lower one geminate (with 2 pupils). Exp. 1·4″-1·7″ .... *asterope.*
  b. Hindwing underside: with three posterior ocelli, the tornal one geminate.
    a^1. Hindwing upperside: brown. Exp. 1·6″-1·7′ ... *huebneri.*
    b^1. Hindwing upperside: partly pure white. Exp. 1·7″.. *ceylonica.*

The ocelli of the underside of hindwing in these last two are all in a line, not échelonned in pairs as in *philomela.* It should be noted that the upperside of hindwing in the last species must be pure white; greyish-white or grey will not do: such is often the colour of the wing in the dry-weather form of *huebneri.* All these butterflies have a wet and dry-season form, the former with all ocelli well developed and the ground-colour finely striated on the underside and rather dark, the latter with the ocelli reduced sometimes there to mere black spots and the whole of the ground-colour on which they are placed suffused with grey-white. This suffusion often invades the upperside in *huebneri.* The larvæ of *philomela* and *huebneri* have the head rounded without horns but have the usual tail-points: they are green and feed on grasses.

Genus—ORSOTRIŒNA.

A. Underside: with a transverse narrow white band hardly 2mm. in breadth. Exp. 1·75″-2″ (*Vide* Fig. 8) .... *meda.*

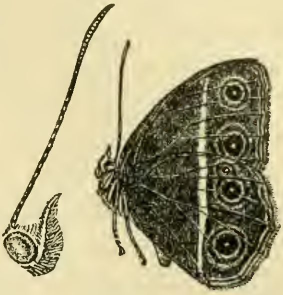


Fig. 8.—*O. meda.* Underside.

B. Underside: the transverse white band much broader, over 3mm. in width. Exp. 1·85″-2·15″ .... *mandata.*

Here again the ocelli on the underside are much more developed in the wet-season forms though these do not differ much in colour from the dry-season insects and there is no shading underneath in either. *Meda* is North Indian, *mandata* South Indian. There is a sex-mark in the male on the forewing above vein 1 consisting of a fold covered by a pencil of long hairs and on the hindwing on each side of the median vein consisting of two recumbent pencils of hair covering a patch of specialised scales. The larva of *mandata* is pink with very long thin horns and shorter tail-points and lives on grasses. The pupa is somewhat abnormal resembling that of the *Morphinæ*.

Genus—ELYMNIAS.

A. Upperside: male, terminal margin of forewing with blue spots; female, black on terminal margin of hindwing not extending along veins. Exp. 2·85″-3·4″ .... *undularis*.

B. Upperside: male, terminal margin of forewing with white spots; female, black on terminal margin of hindwing extending along veins. Exp. 3·4″ .... *caudata*.

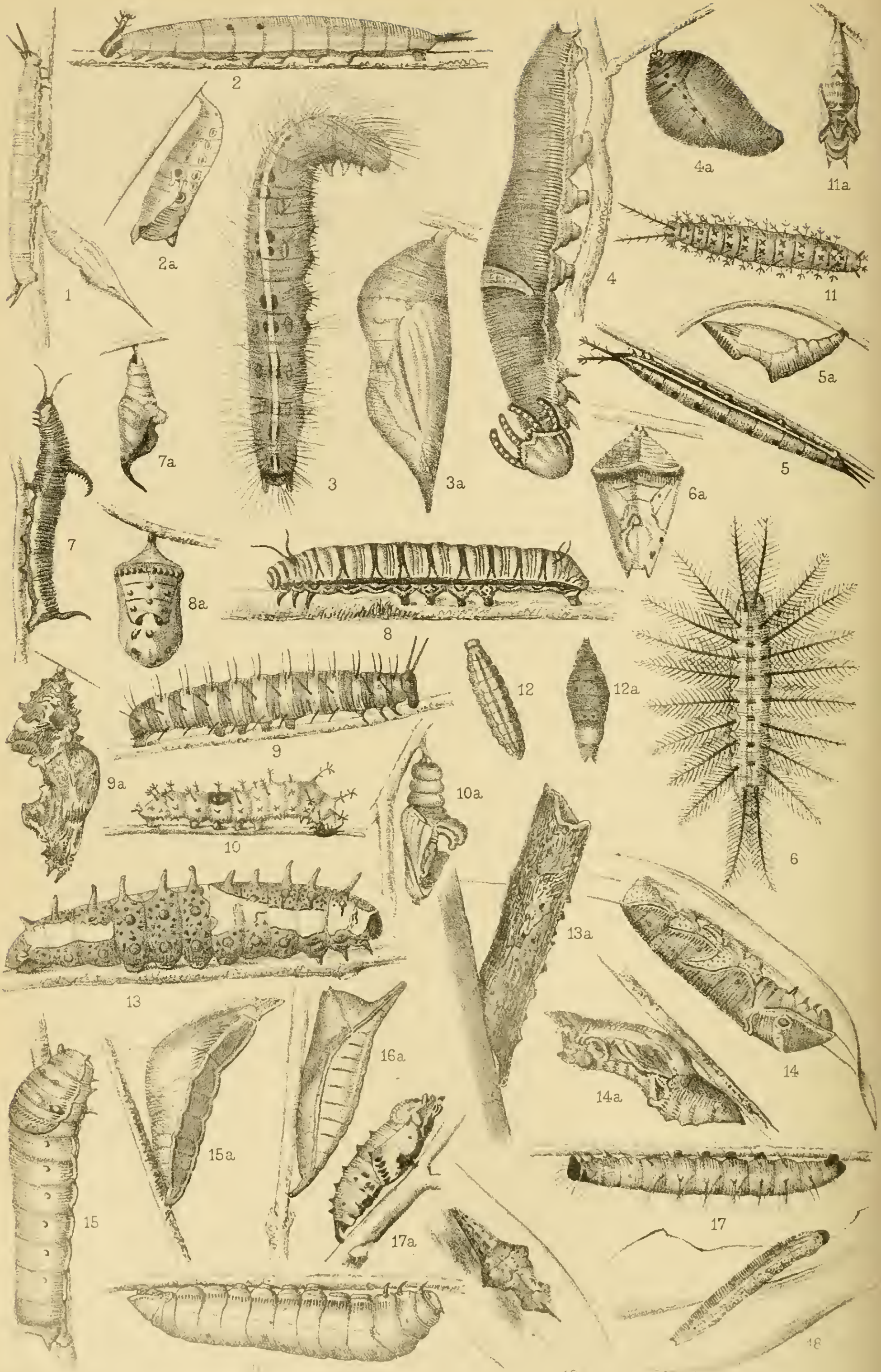
These are both jungle insects of the hills, the first North Indian, the other South Indian. The larvæ are like those of *Melanitis* but are brilliantly coloured as also are the pupæ.

The following butterflies are figured in the coloured plates: *Melanitis ismene* (Pl. D, Fig. 22); *Mycalesis polydecta* (Pl. F, Fig. 37, wet-season and Fig. 37*a*, dry-season form); *Lethe nilgiriensis* (Pl. F, Figs. 38, ♂ and 38*a*, ♀): *Ypthima philomila* (Pl. F, Fg. 39).

The *Satyrinæ* are, generally speaking, insects of the hills and colder climates, not of the plains and tropics. Very few species occur in the lower hills and open country in India and those that will interest us are confined to half a dozen genera out of the twenty-five mentioned in Colonel Bingham's book. Three of these genera contain ninety species of which thirteen only concern us. Out of the twenty species in the foregoing keys the majority are weak on the wing, flying low down near the ground among grasses and undergrowth with a slow jerky flight. The genera *Melanitis* and *Lethe*, especially the latter, contain insects which are strong and quick on the wing though the style of the flight is the same as that of the weaker ones. They are all fond of shade and are to be met with chiefly in the jungles among the undergrowth and dead leaves, or on the edges of clearings: where they may be found sitting on tree-trunks and branches drinking the sap oozing from wounds or on the ground lapping up the toddy fallen from the pots of the toddy-drawers. They rarely visit flowers for food. Their flight is never sustained; they get up suddenly on being disturbed, flutter along for a bit and then drop again suddenly. *Lethe* will rise sometimes straight into the air and disappear among the tree tops overhead and will often settle high up. *Melanitis* will also fly up to a considerable height but nearly invariably returns to the ground to rest after each flight. *Elymnias* is unlike the usual Satyrines in that it never comes to the ground to rest but sits about on leaves in damp shady places in evergreen jungles. This last insect differs from the rest also in the colour of its wings, variegated with purple-black and tawny on the upperside with white or blue spots in the males. All the others are dark-brown, earthy-brown or blackish in colour, without as a rule, any striking markings beyond an ocellus on the upperside. The undersides, however, are extremely varied in shades of white, grey, brown, black, ochreous and purplish with a violet bloom in some species. In *Lethe* some of the males and all the females have white markings on the upperside of the forewing, the latter always more than the former. In the other genera the sexes are more or less alike. All Satyrines have, as a general rule, ocelli on the upper or underside of the wings; they are rarely wanting, as for example, in most species of the genus *Elymnias*. In the dry-season forms these ocelli are, however, very often so reduced in size as to be nearly absent. Seasonal dimorphism exists in nearly all genera and appears chiefly in the size and number of the ocelli of the underside, also in the shade of colouration and even, in *Melanitis*, in a considerable change of the outline of the wings. The great difference in the appearance of one and the same insect in the wet season and in the dry was the cause why each species of these butterflies was formerly split up into two or even three. It was only in the later '80s that the effect of climate upon insects began to be appreciated by the few and it was not until years later that its scope came to be fully recognised.

The Marbled White, the Meadow Browns, the Gatekeeper, Ring lets, Heaths and the Grayling are all English Satyrines; the last exhibiting the same extraordinary adaptation to its surroundings in the colouration of the underside that *Melanitis* does in India; the former

Plate I.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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Explanation of Plate I.

Fig.	1.	Larva and	pupa of	*Orsotriæna mandata*, Moore.
,,	2 & 2*a*.	,,	,,	*Elymnias caudata*, Butler.
,,	3 & 3*a*.	,,	,,	*Discophora lepida*, Moore.
,,	4 & 4*a*.	,,	,,	*Eulepis schreiberi*, Godart.
,,	5 & 5*a*.	,,	,,	*Apatura camiba*, Moore.
,,	6 & 6*a*.	,,	,,	*Euthalia garuda*, Moore.
,,	7 & 7*a*.	,,	,,	*Cyrestis thyodamas*, Boisduval.
,,	8 & 8*a*.	,,	,,	*Danais limniace*, Cramer.
,,	9 & 9*a*.	,,	,,	*Cethosia mahratta*, Moore.
,,	10 & 10*a*.	,,	,,	*Pantoporia inara*, Doubleday.
,,	11 & 11*a*.	,,	,,	*Ergolis ariadne*, Johanssen.
,,	12 & 12*a*.	,,	,,	*Abisara echerius*, Stoll.
,,	13 & 13*a*.	,,	,,	*Papilio clytia*, Linn.
,,	14 & 14*a*.	,,	,,	,, *polytes*, Linn.
,,	15 & 15*a*.	,,	,,	,, *buddha*, Westwood.
,,	16 & 16*a*.	,,	,,	,, *sarpedon*, Linn.
,,	17 & 17*a*.	,,	,,	*Delias eucharis*, Drury.
,,	18 & 18*a*.	,,	,,	*Appias libythea*, Fabr.

(All these are butterfly larvæ.)

adapted to stoney ground and rocks, the latter to vegetable soils and fallen dead leaves: they both have the habit of rising only when forced to during the day, of flying only a short distance before settling again and of dropping to the ground suddenly, closing their wings so as to show little of the upperwing and lying on their sides to expose the whole undersurface of the hindwing.

The Satyrine egg is generally dome-shaped, slightly higher than broad and is covered with minute cells, indistinct, as a rule, sometimes more, sometimes less; it is laid on the undersides of blades of grass or bamboos or leaves of palms (*Elymnias* only), sometimes singly, sometimes several together. *Lethe*, *Ypthima*, *Orsotriœna* and *Elymnias* lay singly, the rest in batches, *Melanitis gokhala* as many as 25 together.

The larva is spindle-shaped without exception, *i.e.*, it is fattest in the middle, thinning considerably to both ends; there are always two tail-points and, very generally, two head-points also (*vide* Pl. I, figs. 1, 2 and 2*a*). The head is either square or round, slightly bilobed with one point or horn on the vertex of each lobe. *Ypthima* is the only genus in this paper that has larvæ with hornless heads: they have, however, small, pointed tubercles, surmounted each by a bristle, instead. The head-points are sometimes developed into regular horns, stout in *Melanitis* and *Elymnias*, slight and long in *Orsotriœna*, tooth-like and small in *Mycalesis*, always well separated at the base except in *Lethe* where they are contiguous and look like one. The tail-points are also well separated except in the same genus where they, too, are as one. The head is always large as compared with segment 2 and there is a distinct neck. The surface of the body is very generally rugose by reason of transverse rows of small conical tubercles surmounted, each one, by a hair. All the larvæ lie full stretched on the undersides of blades and feed from the edge when young in little semi-circles, when grown they eat the ends square off; they do not travel far to pupate and suspend themselves in the usual nymphalid manner in all our species with the exception of that of *Orsotriœna* which is abnormal in this respect. Some of the northern (English also) larvæ pupate without suspending themselves: that of the Marbled White for example just makes a hollow in some moss and changes there; the Grayling is said even to make a cocoon of earth under the surface like a moth. This exceptional procedure has doubtless been evolved as a protection against northern severity of climate.

The pupa differs from the Danaine in being slighter and in the absence of a ridge along segment 7 ; indeed the abdomen is much less swollen as compared to the thorax : there is often a considerable carination along the dorsal line of thorax, a slight lateral expansion of the wings, somewhat emphasised eye-points to the front of head, tubercular risings on the dorsum of abdomen in some species and always a distinct constriction behind thorax. The pupa can move itself from segments 9, 10 and some species produce an audible, dull click in doing so. The colour is very generally green, ornamented with gold along the carination of thorax and edges of wings sometimes ; but, from the habit of pupation low down near the ground close to dead leaves or in dark places, the green of the chrysalis is changed often to bone-colour with dusky dots, &c. The pupæ and larvæ are very much ichneumoned.

The food plants are Grasses including Bamboos and Palms.

The following table will fix the genus of any larva found :—

A. Head round without horns or points.................. *Ypthima.*
B. Head round with two closely applied points appearing as one .... *Lethe.*
C. Head square with well developed horns.
  a. The horns very long and thin .... *Orsotriæna* (*Pl.* *I, fig.* 1).
  b. The horns moderately long and stout.
    a^1. Larva brightly coloured yellow, green and, sometimes, red .... *Elymnias* (*Pl.* *I, fig.* 2).
    b^1. Larva of different shades of green .... *Melanitis.*
D. Head square with short, flattened, conical points. *Mycalesis.*

DESCRIPTION OF SPECIES OF SATYRINÆ.

9. **Mycalesis junonia,** *Butler.*—Male and female : *upperside* dark umber-brown ; both wings with ochraceous-yellow double subterminal line , cilia pale brown. Forewing with a large median and much smaller subapical white-centered black ocellus, the latter with a yellow iris, the former with it white, the upper portion very broad, the lower incomplete, the whole having the appearance of a squinting eye. Hindwing uniform with two very small black ocelli. *Underside* is dull light brown with double subterminal line ; both wings crossed near base by a dark brown line, double on forewing ; followed by a white discal line beyond which are two ocelli on the forewing as on upperside, each encircled

by an extra outer white ring ; on the hindwing a curved series of seven similar ocelli with a white band bordering them on both sides, the first and fifth from costa largest, the fourth and fifth generally coalescent. A large bright ochraceous spot posteriorly on the hindwing in the male. Antennæ, head, thorax and abdomen brown. The male has the following sex-marks : above the dorsum of underside of forewing there is a patch of specialised scales on a satiny-white area ; facing this, on upperside of hindwing, near costa, there is a patch of specialised scales covered by a pencil of long hairs. Exp. 44-52 mm.

Larva.—Body spindle-shaped as for the sub-family, rather stout in the middle, the head large as compared with segment 2, the anal end finishing in two short, conical, fleshy points, close together at origin, then diverging slightly. The head is square, thick, with swollen cheeks and is broadest at the jaws ; each lobe is surmounted by a triangular, short, stout, laterally compressed tooth : the two teeth separated widely at bases and divergent ; surface of head and teeth very finely rugose and extremely minutely haired ; a pair of largish tubercles behind the teeth on margin of head, perhaps three. Surface of body is covered with small tubercles and finely haired. Spiracles roundly oval, dull black. Colour of body is dull dark-brown with a lateral row of about seven lighter brown diamond-shaped markings caused by diagonal lateral lines ; on each segment 5-13 there is, laterally, a central small, white tubercle bearing no hair. L. 28 mm ; B. 3 mm.

Pupa.—It is a dumpy little pupa : with a smooth surface at first sight ; with a trapeze-shaped head, straight and sharp-edged in front, the lateral corners angled ; segment 2 short ; dorsal line of head, segment 2 and front half of segment 3 is nearly perpendicular to the longitudinal axis of pupa ; the thorax is humped, slightly carinated in dorsal line and short, evenly convex ; a distinct shallow constriction behind thorax ; abdomen stout, circular in transverse section, higher at segment 6 than apex of thorax, segment 7 being the highest and broadest part of body ; wings very slightly expanded in parallel lines along their dorsal margins ; the cremaster is short and square with two large lateral round tubercles on each side of base and is fixed so that the pupa hangs very much inclined towards the surface it is suspended from. Spiracles of segment 2 linear ; others oval, raised. Surface of wings and body minutely and irregularly pitted ; subdorsal low tubercular rising on segments 5-9, some white, low rounded tubercles on wing-surfaces. Colour bluish dark-green, dorsal line of wings, cremaster and front margin of head broadly red-brown. The ventral line of wings is slightly convex, not straight. L. 11·5 mm ; B : 6 mm.

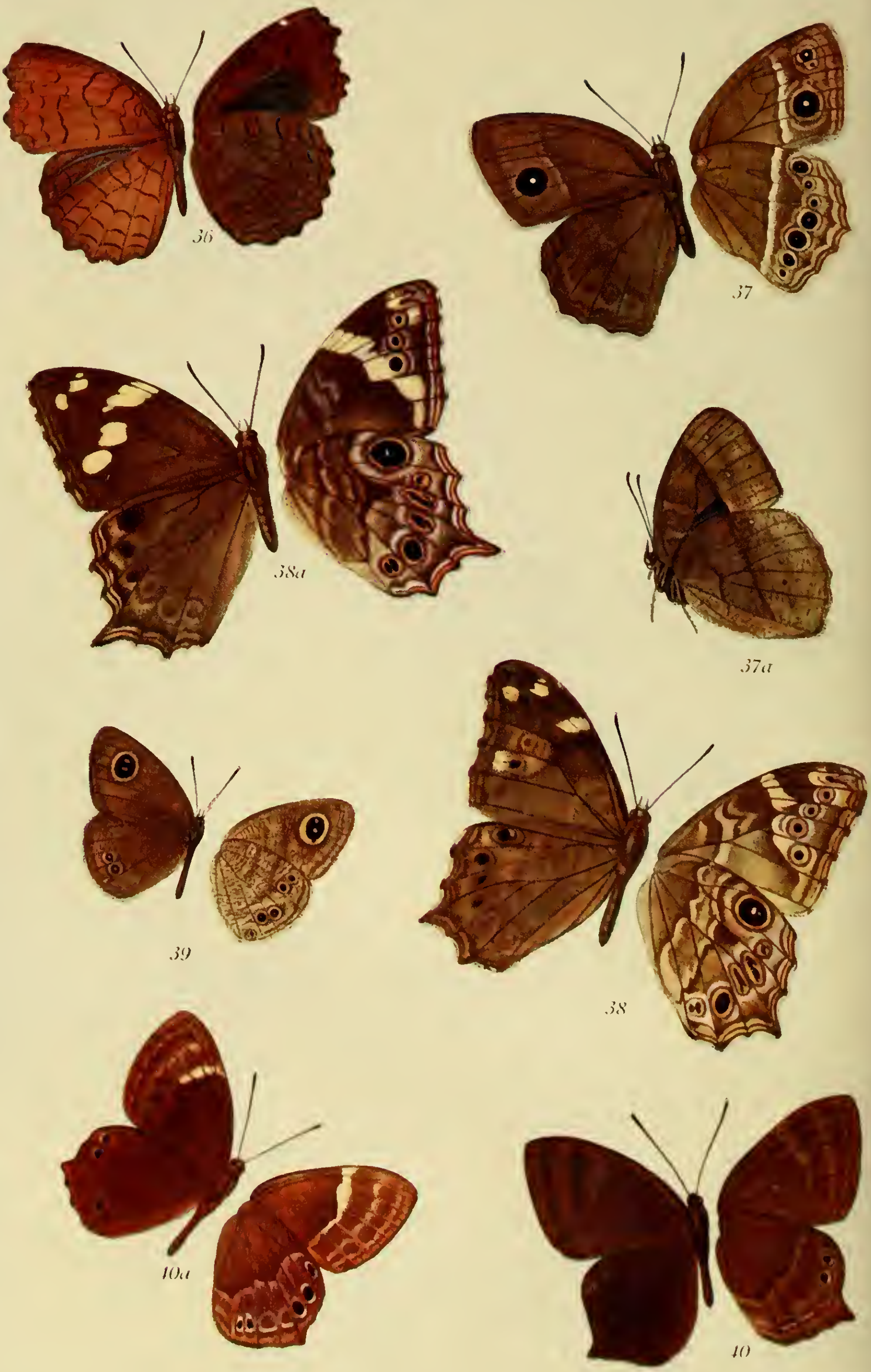
Habits.—The egg is laid on the underside of a blade of grass, generally a soft grass, in the jungles among the undergrowth or on the edge of a path or clearing. The larva, emerging, keeps to the underside of the blade or low down on a stalk, lying often with its head turned back on its side, holding on only with the prolegs. The pupation takes place on the underside of a blade, from a perpendicular stalk or even against the side of a rock sometimes, always close to the ground. The imago is common enough in the Kanara District above and below the ghats at all times of the year, always in jungles, however, hardly ever venturing into any considerable open space. There is no reason why it should not occur in Kolaba or Thana. In the monsoon the colours of the underside become much brighter, the white bands then becoming leaden or silvery. The insect is confined to the hills of Southern India. Needless to say the larva feed on grasses. It will eat rice.

10. **Mycalesis visala,** *Moore.*—Male and female : *upperside* dark vandyke-brown ; both wings with double subterminal pale line. Forewing with a single, white-centred, fulvous-ringed, black ocellus, generally set in a square pale area in interspace 2 ; occasionally a similar small ocellus without pale area in interspace 5. Hindwing uniform, sometimes with one or two obscure postmedian ocelli. *Underside* : ground-colour similar ; fore and hindwing crossed by a transverse dusky-white discal band, well defined inwardly, diffuse outwardly, followed by a postdiscal series of ocelli surrounded by a dusky-yellowish, sometimes purplish-white line ; the ocelli are similar to the ocelli on the upperside and vary from two to four on the fore and from five to seven (the preapical two being sometimes obsolescent) on the hindwing ; of these the posterior *four* are in a straight line ; finally, beyond the rows of ocelli there is a double, pale or purplish-white subterminal line. Exp. 52-61 mm.

In the dry weather the *upperside* becomes lighter in colour ; the *underside* varies from ochraceous brown to dusky brown of a darker shade ; the basal half of wings is conspicuously darker than the outer half ; the whole surface irrorated with fine brown striæ ; sometimes a distinct dark discal fascia crosses both wings ; ocelli nearly obsolete, indicated by minute white or black specks, the posterior four on the hindwing in a straight line. Antennæ, thorax and abdomen brown ; the club of the antennæ with black and ochraceous marks. The male has a patch of specialised scales set in a satiny area on underside near dorsum of forewing and a patch of specialised scales near costa of upperside of hindwing covered by a pencil of long hairs (*vide* fig. 6).

Habits.—The transformations of this species are not known. Its distribution is Himalayas, Bengal, Central Provinces, South India, Burma and Tenasserim. The insect is plentiful in the bamboo jungles of Western Ghats, especially in the vicinity of rivers and evergreen jungles. The sex-mark on the underside of the forewing of the male is long and extends beyond the transverse line crossing the wings which distinguishes it from *M. polydecta.* The acuteness of the forewing is most apparent in the dry-season forms.

11. **Mycalesis perseus,** *F.*—Male and female : *upperside* dark to some-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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del. Hentschel-Colourtype.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

Description of Plate F.

Fig. 36. *Ergolis ariadne*, Linn., ♂.
,, 37. *Mycalesis polydecta*, Cramer, wet-season form.
,, 37*a*. do. do. do. dry-season form.
,, 38. *Lethe nilgiriensis*, Guerin, ♂.
,, 38*a*. do. do. do. ♀.
,, 39. *Ypthima philomela*, Johanssen.
,, 40. *Abisara echerius*, Moore, ♂.
,, 40*a*. do. do. do. ♀.

what pale vandyke-brown. Forewing with a white centred, fulvous-ringed, black ocellus in interspace 2 and, rarely, a very small but similar one in interspace 5. Hindwing uniform, occasionally two or three obscure postmedian ocelli present. Both wings with the double pale subterminal line. *Underside* with the ground-colour and subterminal lines as on upperside, but crossed by a purplish-white narrow discal fascia. Forewing with from two to four, hindwing normally with seven ocelli similar to, but more clearly defined than, the ocelli on the upperside ; on both wings the line of ocelli bordered inwardly and outwardly by sinuous purplish-white lines. On the hindwing only the *three* posterior ocelli in a straight line, the rest strongly curved outwards. In the female the large ocellus on the upperside is always larger than in the male. Exp. 42-54mm.

In the dry-season form the *upperside* is similar, the median ocellus generally smaller. *Underside* brown, more or less suffused with purple and irrorated with darker brown, minute, transverse striæ ; the transverse discal band obscure, often merely indicated by black dots at the veins, occasionally bordered outwardly by an ochreous diffuse band. Ocelli obsolescent ; but, when present, mere dots arranged as in the wet form. Antennæ, head, thorax and abdomen brown ; antennæ sometimes cinereous, white on the sides with the apex black. The male sex-marks as in *M. visala* but that on underside of forewing small (about 2mm. long) and black (*vide* fig. 6).

Habits.—The transformations of this are not known. The distribution is from the Himalayas to China and into the Malayan Sub-region, Bengal, South India, Ceylon. It is common in the same places as the last.

12. **Mycalesis polydecta,** *Cramer* (Pl. F, figs. 37, wet-season ♀ ; 37*a*, dry season ♀.)—This is exactly similar to *M. visala* described above except that the discal transverse band on the underside is much broader and pure white. The species can also be distinguished from *visala* by the apex of the forewing being rounded instead of acute and, in the male, by the sex-mark on the underside of forewing being black and only about 3mm. in length (*vide* fig. 6). Exp. 48-56mm.

Larva.—The larva is very like that of *M. junonia.* The head is comparatively somewhat larger, the surface very rugose, set thickly with conical hair-bearing tubercles ; the hairs are light in colour, the head itself very dark brown, yellowish at hinder base of apical teeth ; clypeus red-brown, shiny, glabrous. The head is twice the diam. of segment 2. The tail-points are longer than those of *junonia.* Spiracles roundly oval, shiny, black. Surface of body as well as tail-points covered densely with small semi-hyaline tubercles each bearing a short black hair ; these tubercles arranged in transverse ridges. The colour of body is brown-green with a dark dorsal pulsating line, a diagonal lateral blackish mark on each segment, plainest on the central segments and some darkish mottling underneath these diagonal lines towards the dorsoventral margin, slightly tinged with reddish-yellow ; ventrum watery green brown ; true legs the same colour as head ; prolegs the colour of the belly. The paired bodies under the skin on each side of dorsal line (in male only) are yellowish. L. 30mm ; B. slightly over 3mm.

Pupa.—The chrysalis is also very like that of *M. junonia* though perhaps not quite so "dumpy." The constriction is perhaps a little less. Cremaster truncated, triangular, longer than broad with a central dorsal and ventral depressed line. Spiracles oval, light in colour ; of segment 2, linear. Surface minutely and irregularly rugose with a yellow subdorsal, rounded tubercle on segments 5-9, a black spot above spiracle on segments 9-11. The colour is grass-green with the cremaster red. L. 13mm.; B. 6mm.

Egg.—Dome-shaped, constricted a good deal at base and therefore broadest at one-fifth the height from base ; looks spherical at first sight. Surface shiny, obsoletely celled. Colour green. H. 0·85mm., B. 0·8mm.

Habits.—The egg is laid either on the underside or upperside of a blade of grass, on a stalk, on a dried root, on the ground close by anywhere ; very often four and five being laid together. The little larva which is at first green with a reddish dorsal line and red tail-points and black head, lives on the blade or on the stalk. After growing a bit the larva rests on a stalk with its head turned round on its side, holding on by the prolegs. Pupates low down near the ground on a leaf, stalk, dead twig, &c., the pupa hanging free though firmly fixed by the tail. The butterfly is the commonest of the genus and exists in the Central Provinces southwards to Travancore. It may be seen fluttering about the rice-fields around Bombay in the monsoon and extends into the hills and jungles.

13. **Mycalesis perseoides,** *Moore.*—Male and female closely resemble *M. polydecta.* The disposition of the ocelli on the underside separates it from *perseus* ; from *polydecta* it differs in the male sex-mark on the underside of forewing being longer, broader and brown in colour. Exp. 44-56mm.

Habits.—A variety of this, according to Col. Bingham, comes from Mysore in South India. He says the specimens, all males, belong to the dry-season form ; that they are uniformly smaller than typical *perseoides* and differ on the upperside of the forewing in the very broad pale iris surrounding the median ocellus and, on the underside of the same wing, in the margin of the darker basal portion of the wing being prominently concave just above the dorsal margin. The male sex-mark on the underside of the forewing is larger than that of *polydecta* but resembles it in colour. The transformations of the species are not known. The typical form comes from Burma and Tenasserim.

14. **Mycalesis subdita,** *Moore.*—Male and female closely resemble *M. polydecta.* The male can be discriminated by the sex-mark on the underside of the forewing, this is brown or ochraceous brown as in *perseoides,* but very much longer and broader, extending to, but not going beyond, the transverse band crossing the wings (*vide* fig. 7). Exp. 48-60mm.

Habits.—The transformations of the species are not known. Its distribution is given as South India, Travancore and Ceylon.

15. **Lethe europa,** *F.*—Male and female have the inner third of the hindwing covered with long brown hairs. *Male upperside* rich dark brown. Forewing with the oblique, short, white discal fascia of the underside showing through, two obscure black spots or ocelli, followed by two prominent white spots, the upper one double, some black markings margined outwardly with pale dusky brown along terminal margins of both fore and hindwing and an obscure subterminal pale line on the latter. *Underside* very dark blackish-brown ; the wings crossed sub-basally by a slender lilacine-white straight line, followed on forewing by an oblique white discal fascia, and on both fore and hindwing by a postdiscal series of large black ocelli and a terminal, somewhat ochreous, narrow band bordered on the inner side by a more or less silvery purple line. The series of ocelli on both wings margined inwardly and outwardly by silvery purple lunular lines, on the forewing curved inwards, on the hindwing curved outwards ; the ocelli on forewing confluent, black, non-pupilled ; on the hindwing black with disintegrated silvery-speckled irregular centres on the brown ground. Female similar : forewing on *upperside* with an oblique broad white discal band, hindwing with a postdiscal incomplete series of black spots. *Underside* similar to that of male, markings and ocelli larger. Exp. 62-76mm.

Habits.—The larva and pupa are very similar to those of the next species, *L. drypetis* and the larva feeds upon bamboo. The butterfly is found in the plains of Northern India, the lower hills of the Himalayas, Assam to Tenasserim, China and the Malay Peninsular, the Western Ghats along the coast. It is a strong flier and is often seen sitting on bamboo-leaves ; affects the jungles by the sides of rivers, especially where the ground is flat.

16. **Lethe drypetis,** *Hewits.*—Male : *upperside* very dark vandyke-brown forewing uniform ; hindwing with a postdiscal series of blind, black ocellar spots. *Underside* brown ; forewing below vein 2 and terminal margin paler, a broad band across the cell, the wing suffused with lilac medially and at apex, bearing an incurved postdiscal series of five blind black ocelli. Hindwing : sub-basal and discal narrow transverse lilac bands, the former sinuous, the latter angulated on vein 4, and an arched postdiscal series of black, fulvous-ringed ocelli, some with disintegrated centres ; the wing medially suffused lilac, the ocelli with lilacine lunules on both sides. Both wings with slender

lilacine subterminal and broader ochraceous terminal line. Female similar: ground-colour paler ; a broad oblique white discal bar and two white preapical spots on the *upperside* of the forewing ; a large rectangular black, subterminal mark in interspaces and a white spot above and below it, on the upperside of the hindwing. *Underside* similar to that of male, all the markings more prominent, the lilac, ochreous and brown shades paler ; the broad discal bar on forewing as on the upperside, joined by a nearly vertical lilacine-white band bearing the series of ocelli. On the hindwing the brown transverse discal band very broadly produced between veins 4 and 5. Antennæ, head, thorax and abdomen brown ; antennæ ochraceous at apex. Exp. 64-68 mm.

Larva.—The body is spindle-shaped, flattened ventrally, with a pointed head and the last segment is produced out behind into a long pointed tail composed of two closely applied, long, conical processes. The head is a good deal higher than segment 2, though very slightly broader, triangular in shape, thick at base, produced on the vertex into a longish point composed of two closely applied pointed conical processes, one from vertex of each lobe ; jaws black ; general colour green, darker than the body, the points red ; a yellow line down each side from base of points at vertex to meet the spiracular body-line. Spiracles brown, oval, small. Surface of body covered with minute white pointed tubercles, as well as the head, each tubercle surmounted by a minute hair. Colour of body lightish grass-green with a dorsal thin white line flanked by a subdorsal one on each side ; an interrupted yellow lateral-band broadening out into patches with deep rose-coloured centres on segments 7 and 8 and into lunules of yellow on segments 5, 6, 9 and 10 ; and a light yellow spiracular line from segment 4 to centre of tail-points, bordered above finely with brown. Sometimes there is no rose-colour, other times there is little yellow ; occasionally the whole colour may be rosy brown instead of green with diagonal side-lines. L. 44mm.; B. 4mm.; L. of tail-points: 4mm. ; of head points 1mm. The 44mm. is over all, tail-points and head-points included for the larva lies with the head-points lying in a line with the body.

Pupa.—The chrysalis is not swollen in the abdomen, has two short points to the head, an angular thorax-vertex and is otherwise nearly smooth. The head has two squarely separated conical short points, one in front of each eye ; the distance between these points being half the breadth of pupa at shoulders. The head and segment 2 are trapeze-shaped seen from above ; lateral outline widening rapidly to shoulders with a shallow sinus at segment margin 2-3 ; from shoulders to segment 8 the breadth decreases but slightly and from there to end very gradually also, the abdomen being strongly convex in the dorsal line though ventrally nearly straight ; the thorax is convex running up to a point at apex in the dorsal line (lateral view is thus triangular), the anterior slope to head being rapid, the posterior to segment 4 gradual. Constriction behind thorax is moderate ; the wings are expanded very little behind the shoulders. Cremaster is thickened at end, triangular. The last three segments are bent down so that the pupa hangs at an angle of 45° to the vertical.

Spiracles of segment 2 linear, yellow ; rest oval, light and small. Surface of pupa is smooth and somewhat shiny. Colour grass-green ; dorsal wing-margin continued to points of head over the shoulders are yellow, sometimes golden ; apex of thorax yellow ; a subdorsal tubercular mark on segments 5-9 small, conical, yellow. L. 18 mm. ; B. 7mm. The pupa may be rosy brown like the larva.

Habits.—The egg is laid singly on the under side of a leaf though it is the rule to find two or three adjacent leaves with one each. The young larva eats the shell and afterwards always stays full-stretched on the under surface with its belly closely applied and its face bent down so as to bring the head-points to project straight forward in a line with the body. The larva is then not at all easy to make out being of a similar shade of green to the leaf. The larvæ are generally to be found on leaves within two or three feet of the ground in shady places. They feed on bamboo and seems to prefer the big thorny one, *Bambusa arundinaceæ.* The butterfly is confined to South India and Ceylon but is extremely plentiful in the jungles of the Western Ghats in Belgaum and Kanara and probably, therefore, further north where the conditions are similar as regards climate. It is a swifter flier than the preceding species and is found just as much above the ghats as below, in hilly places and on the flat in equal numbers. It does not visit flowers but is very fond of toddy and sap-juices.

17. **Lethe Nilgiriensis**, *Guerin* (Pl. F. , figs. 38♂, 38*a*♀).—Male and female : *upperside* vandyke-brown, slightly darker, especially in the female, towards apex of forewing. Male : forewing with a costal and two preapical spots white as well as a fourth in interspace 2 towards the termen. Hindwing : the ocelli of the underside showing through, sometimes forming two or three obscure black spots ; two slender subterminal black lines. *Underside* paler, shaded with dark-brown. Forewing : narrow sub-basal and outer cellular transverse sinuous white lines ; an irregular broad discal and a narrower postdiscal band white, forming a V, the latter bearing a series of four blind, dusky-black, fulvous-ringed ocelli ; the two preapical white spots as on the upperside ; distinct slender subterminal whitish and broader terminal ochreous line. Hindwing : a sub-basal, transverse, sinuous light band bordered whitish ; a postdiscal arched series of six black ocelli, their centres disintegrated, their inner ring ochraceous, outer brown and the whole series bordered inwardly and outwardly by lilacine-white lines ; finally the same subterminal whitish and terminal ochreous lines as on forewing. Female : *upperside* differs in having a broad, oblique, white discal band on forewing divided into three distinct spots. *Underside* as in the male but the markings more pronounced, the white discal band continuous. Exp. 64-66mm.

Habits.—The description of the larva as given by Moore is not sufficient to distinguish it from that of *drypetis* and, no doubt, they are very similar. The food plants are grasses. The butterfly occurs in Central and Southern India and on the West Coast as far north as Mount Abu in Gujerat. This is the weakest flier of the three species and is less of a forest and hill species than either of the other two; it also keeps much more to the ground, frequenting grassy places. It is not often seen in the heavy jungles of the hills much south of Bombay.

18. Melanitis ismene, *Cramer* (Pl. D, fig. 22).—Male and female in the wet season have the forewing with the apex subacute, the termen slightly angulated just below the apex, or straight. *Upperside* brown. Forewing with two large subapical black spots, each with a smaller spot outwardly of pure white inwardly bordered by a ferruginous interrupted lunule; costal margin narrowly pale. Hindwing with a dark, white-centered, fulvous-ringed ocellus in interspace 2 near the termen, other ocelli sometimes showing through from the underside. *Underside* paler, densely covered with transverse dark-brown striæ; a discal curved dark-brown narrow band on forewing continued on to hindwing and a postdiscal similar band on the forewing followed by a series of ocelli, that in interspace 3 the largest of four, six on the hindwing, the apical and subtornal the largest. The discal bands may be obsolescent, some of the ocelli may be wanting.

In the dry season the forewing has the apex obtuse and more or less falcate; termen after the falcation may be straight or sinuous. *Upperside* ground-colour similar to that in the wet-season form though somewhat darker in fresh specimens, the markings, especially the ferruginous lunules inwardly bordering the black subapical spots on the forewing, larger, more extended below and above. Hindwing: ocellus in interspace 2 absent, posteriorly replaced by three or four minute white subterminal spots. *Underside* varies in colour greatly in shades of ochreous-brown, yellow, grey-black, nearly always with the discal and postdiscal fasciæ distinctly defined and darker than the ground-colour and the ocelli completely disappear. Antennæ, head, thorax and abdomen in both seasons is brown or greyish brown; antennæ annulated white, ochraceous at apex. Exp. 70-80mm.

Larva.—Body spindle-shaped though approaching cylindrical; tail end produced into two nearly parallel conical points directed straight backwards, as long as the head-horns, squarely separated at base and set with hair-bearing tubercles like the body. The head is square, higher than broad, with a convex face and two perfectly cylindrical diverging horns, one on vertex of each lobe, widely and squarely separated at bases, lying in the same plane as the face and about three-quarters as long as height of head; the head is thick, the surface is finely rugose, shiny, covered thickly with fine white hairs; the horns set with small tubercles each surmounted by a white or black hair; colour of head is darker-green than the body with a broad white cheek-stripe flanked in front by a narrow black line; jaws yellow; sometimes the head is suffused more or less with black; horns dark vinous-red. The head is much broader than segment 2. Spiracles oval, small, red-brown. Surface of body covered with transverse rows of smooth, round, white hair-bearing tubercles, about six rows to each segment, there being a depressed line between each row; the hairs are erect, colourless and short. The ventrum has similar hair-bearing tubercles but they are sparse. Colour of body is a bright yellowish grass-green with a dark-green dorsal line and an indistinct lateral yellow line; ventrum slightly glaucous-green. The dorso-ventral margin is ever so slightly flanged. L. 39mm. over all; B. 6mm.; L. of horns 2mm.

Pupa.—Chrysalis like that of *Lethe* but without angulations of any sort. The head is square in front, the edge being sharp; the front slope is nearly perpendicular to longitudinal axis, the lateral lines diverge towards shoulders. Segment 2 is convex, broad, less inclined to longitudinal axis than head, its front and hinder margins distinct. Segment 3 has its front slope in the same plane as segment 2, the apex is evenly convex and very slightly carinated in the dorsal line, the hinder slope is nearly at right angles to front slope and nearly parallel to the longitudinal axis of pupa. The shoulders are slightly prominent. The ventral line is nearly quite straight throughout its length. The pupa is circular in transverse section from segment 4 to anal end, of the same breadth from shoulders to segment 8, though there is a slight constriction at segments 4-6, gradually thinning to end; highest at thorax-apex; stoutest at segment 8. The cremaster is inclined towards ventral line, cylindrically oblong with a dorsal depressed line and ventral extensor ridges joining behind in a point. Spiracles linear, reddish, small; those of segment 2 not evident. Surface of body very finely transversely lined, naked, shiny. Colour a uniform watery grass-green; wings veined darker; cremaster bluish. L. 21mm.; cremaster 1·7mm.; B. at segment 8, 7·75 mm.; B. at shoulders, 7mm.; B. at front of head, 3mm.; H. at thorax-apex, 7·2mm.

Habits.—The egg is laid on the underside of a blade of grass or rice either singly or in a row of from 2 to 7: the larva, emerging, lives constantly on the underside, closely applied to the surface: the pupation takes place by suspension from the under-surface of the leaf or a twig, &c., by the tail, free but firm, hanging perpendicularly down. The pupa when touched wriggles from side to side moving from the abdominal segment-margin 9-10, making at each change of position, or at each wriggle, a knocking noise. The butterfly has a very wide range being found in Africa south of a line joining Ashanti to Abyssinia, in Madagascar, Mauritius: is common throughout India and Burma and extends through the Malayan Region to Australia. The insect is as plentiful in India in the hills as in the plains, on the sea coast as in the interior of the country, in the dense jungles as in the open "maidans". The only places where it is wanting more or less are the sandy wastes in Sind and Rajputana and this is probably due to the scarcity at certain seasons of its food plants: grasses and rice. In Bombay generally, exclusive of Sind, it is probably the commonest butterfly of the Presidency and in certain jungly localities it exists in such numbers in some years as to become a positive nuisance, pouring into the bungalows when the lamps are lit of an evening and covering the walls from floor to ceiling. It has a somewhat weak jerky flight and rarely, except in the early mornings or in the evening, stays on the wing more than a few seconds at a time, settling always on the ground, generally sideways with its wings closed as already pointed out. In the monsoon months it may be seen flying over the rice-fields in the morning and evening: most probably in quest of a mate.

19. **Melanitis veraha,** *Moore.*—Male and female with the costa more strongly arched than in *ismene*; apex and termen the same. *Upperside* male is fuliginous-black; female similar to *M. ismene*; except that the ferruginous or ochraceous markings on the upperside near the apex of forewing are absolutely wanting and the smaller white spots are absent in both sexes. Hindwing uniform without ocelli; in a few specimens the mere trace of a subterminal ocellus in interspace 2. *Underside* similar to *M. ismene* but the ground-colour darker and the transverse striæ not so clear and well defined, the transverse brown fasciæ obscure. Exp. 68-70mm.

In the dry season the apex is more falcate than in *M. ismene. Upperside* of male and female as in the wet-monsoon forms except that the terminal margins of both wings are always pale purplish. Females have the ochraceous markings near apex slightly developed. *Underside* as in *M. ismene,* very often vinous-red or purplish with large chalky-white spots towards termen, especially of hindwing.

Larva.—The larva is nearly identical with that of *M. ismene.* Spiracles very small, oval, brown. Body surface covered by transverse rows of white, conical tubercles, each bearing a white hair or seta there being six such rows to each segment. Colour of larva is bright grass-green washed with yellow with a dark-green dorsal line and a faint yellow lateral and subspiracular line. The colour of the head is blue-green with a white band from base of horn to jaw and a brown line parallel to it and in front of it; horns themselves reddish-yellow. Some larvæ may have the head black, the cheek-stripe black or red-brown with the head green. L. 38mm.; B. 4·5mm.; L. of anal points, 4mm.; of head-horns, 38mm.

Pupa.—Narrower at head than anywhere else; segment 7 is the highest point and the broadest. Wings expanded slightly parallel to longitudinal axis ; abdomen very convex dorsally ; constriction wide and rather pronounced; thorax humped and front slope of pupa very sudden ; front of head square ; cremaster longish, oblong, thickened at end. Colour watery grass-green. L, 39mm.; L of cremaster, 2mm.; B. 6mm.; B. of head at front, 2·75mm.; H, at thorax-apex, 6·25 mm. Very like that of *M. ismene.*

Habits.—The habits are the same as for *M. ismene ;* the eggs are always laid in twos, threes and fours, generally on the underside of the blades of soft grasses in the jungles. The larva curls up and falls to the ground when touched or alarmed ; the pupa is attached firmly enough but hangs very free. The butterfly is a much weaker flier than *M. ismene,* never at any time rises far from the ground and has a very fluttering flight ; it is a jungle species altogether and affects the evergreens more than the deciduous forests. The colouration of the underside is, if possible, even more varied than in *M. ismene.* The species is supposed to be confined to South India. Colonel Bingham treats it as a race of *M. bela,* Moore from the Himalayas, Assam, Burma and Tenasserim ; and he is probably correct.

20. **Melanitis gokhala,** *Moore.*—Male and female: *Upperside* umber-brown, the black subapical spots diffuse and generally in both wet and dry-season forms without the white smaller spot ; the black costal patch beyond apex of cell, more or less obscure in *M. varaba,* is prominent in this species and is extended to the upper subapical spot. In the males the *underside* is almost always suffused at the base with inky blotches. Exp. 70mm.

Larva.—The body is the same shape as that of *M. ismene,* the tail-points and horns are similar, the former slightly curved upwards. The head is square, larger than segment 2, with two divergent, truncated cylindrical horns, which are as long as the head is high and yellow in colour with black tips and are set with short black hairs ; mandibles yellow, bases black ; a white cheek-stripe from base of each horn to a black patch at base of cheek ; clypeus light-coloured with a black border ; a central dark-brown line down centre of face splitting at apex of clypeus. Body rugose with five transverse rows of minute white setiferous tubercles to each segment. Spiracles are small, oval, light in colour. Colour of body is light grass-green with a dark-green dorsal band, two lateral dark-green lines and a spiracular white band bordered above narrowly with dark green. Colour of head blue-green with minute white and black hairs ; face rough and covered with black hairs. L. 50mm. of which the tail-points are 2mm. ; the hair-horns are 2·25mm. in length ; B. 5mm.

Pupa.—The pupa is not to be distinguished from that of *M. ismene* in anything but its superior size ; it is the same in shape, colour, surface, spiracles, &c. But of course there are large pupæ as well as small as there are different sized larvæ.

Habits.—The eggs are laid in batches of from 4 to 25 on the underside of a bamboo-leaf; the larvæ are gregarious at first and keep together until the last moult when they separate for good, each one going its own way. The pupæ are attached in the same way as that of *M. ismene.* The egg-larva has a shiny black head without any horns, these appearing with the first moult. A batch of 22 were found on the 6th of September before the first moult. These moulted all on the 8th; again on the 13th; again on the 18th and for the last time on the 24th to the 28th irregularly, some earlier than others. The first of these larvæ pupated on the night of the 3rd of October, the last of the batch on the 9th. Six butterflies came out on the 17th and the rest between that and the 22nd; of these half were females, half males. The habits of the butterfly are exactly the same as for *M. ismene* except that it is only found in jungle country. Foodplant: bamboo.

21. **Melanitis zitenius,** *Herbst.*—Male and female: forewing with the costa strongly arched, the apex acute; termen immediately below apex in male being angulate, in female falcate. *Upperside* resembles *M. ismene,* but the ground-colour on the whole somewhat warmer brown, a very broad patch of ochraceous yellow, above and beyond the subapical black spots, larger in the female than in the male. *Underside* closely irrorated with dark-brown striæ; the ocelli subequal, very much smaller and less clearly defined than in *M. ismene.* Exp. 82-90 mm.

In the dry-season form the costa of the forewing is less strongly arched in both sexes and the apex is very falcate. It has much more ochraceous on the forewing than the wet-season form: this forms a very broad band passing from the costa above and beyond the subapical black spots, spreading below and encircling them except for a narrow band which joins them to a large black mark beyond apex of cell. Hindwing with two or three subterminal white spots posteriorly. *Underside* as in *M. ismene* but not quite so variable, the ocelli often entirely obsolete.

Habits.—The range of the insect is South India, Sikhim, Assam to Burma and Malay. It is a forest species and seems to be confined to the hills. The larva and pupa are unknown.

22. **Melanitis bethami,** *de Nicéville.*—Male and female have the shape of the wings as in *M. zitenius. Upperside* very dark blackish-brown, paler along the terminal margins, the subapical black spots wanting; a tolerably large preapical orange yellow patch on the forewing, larger and generally extended to the termen in the female, bearing in interspace 3 a round, white-centred black ocellus. *Underside* purplish-brown, somewhat closely and evenly irrorated with short transverse dark-brown striæ; forewing with four obscure, hindwing with six, postdiscal small ocelli. Exp. 72-84mm.

In the dry season the sexes have the forewing more falcate than in the wet season. *Upperside* : ground-colour a warmer richer brown, the terminal margins broadly ashy ; the orange-yellow patch on forewing much larger, subtriangular, inwardly extending almost to the apex of the cell, outwardly sometimes to the apex and termen of wings ; subapical black spots, bearing a white spot on their outer margins, small but always present, completely surrounded by the orange-yellow. Hindwing with one or two white spots near tornus. *Underside* very variable as in all species of the genus. Antennæ brown marked with ochraceous-yellow in the male ; head, thorax and abdomen dull brown.

Habits.—The transformations of the species are unknown. The butterfly was first caught at Pachmari in Central India and has never been got anywhere else.

23. Ypthima philomela, *Johannsen.*—(Pl. F, fig. 39) Male and female: *Upperside* brown, terminal margins of wings broadly darker. Forewing with a slightly oblique bi-pupilled, comparatively large, yellow-ringed, black ocellus near apex. Hindwing with generally two similar but smaller postdiscal posterior ocelli. *Underside* ochraceous-white, closely irrorated with delicate slender transverse brown striæ ; both fore and hindwing with obscure subterminal transverse brown fasciæ : sometimes wanting. Forewing with the ocellus as on upperside, but with the yellow iris broader, surrounded by an obscure brown ring. Hindwing with six unipupilled similar but smaller ocelli more or less in échelon in pairs ; tornal ocellus geminate. Antennæ, head, thorax and abdomen brown, paler beneath. The male has a sex-mark in the shape of a patch of specialised scales on upperside of forewing which may be extensive and dark in colour. Exp. 32-35mm.

In the dry season the *upperside* is similar to the wet-season form but paler, the subterminal dark bands less distinct. *Underside* also similar, the ground-colour more dusky ochraceous, the brown striæ somewhat diffuse ; ocelli on underside reduced to mere specks. The species is figured on Plate F, fig. 39.

Larva. —The shape is spindle-shaped with a round head slightly larger every way than segment 2, last segment ending in two short, stout, conical points separated squarely at bases and slightly diverging ; the belly is flattened. The head is round, somewhat flattened on vertex, thick, with a depressed line down centre ; finely rugose on surface being set sparsely with rather long conical tubercles on the vertex and shorter ones on cheeks, each tubercle surmounted by a hair ; face sparsely set with erect hairs. Spiracles oval, small and black. Body surface covered rather thickly with tiny white tubercles, each surmounted by a short, light hair and interspersed with larger white tubercles each bearing a longer brown hair ; all the tubercles disposed in transverse rows as usual. The colour of body is dull lightish yellow-green ; head and tail-points light watery reddish-brown. Some specimens are pinkish-brown all over with lateral and spiracular light waved lines : the interspace between these lines being striated parallel to them ; also a subdorsal indistinct waved line and a dorsal, irregular, darkish band in which is a still darker spot near the front margin of each segment. L. 23mm. ; B. 3mm.

Pupa.—This is of the type of that of *Mycalesis* but more angular. The head is trapeze-shaped from above, the front margin sharp and straight. Segment 2 moderately wide ; eyes slightly carinated on top. Shoulders abruptly broader than segment 2. Wings slightly expanded laterally, the lines being nearly parallel but slightly curved inwards at centre. The front slope of head and thorax is perpendicular to the longitudinal axis of pupa ; thorax humped evenly, the dorsal line somewhat highly carinated. Constriction moderate dorsally, laterally very slight. The pupa is broadest at the shoulders, slightly narrower, at segment 6—7 after which the abdomen gradually diminishes in diameter to the short, stout, square-ended, conical cremaster which is inclined at a right angle or even more to the ventral line of pupa. Spiracles roundly oval, dark, conspicuous. Surface of wings flat, the ventral line somewhat flattended, straight from head to segment 9, after which it is curved. Segments 7 and 8 have a prominent, transverse wavy ridge dorsally along their hinder margins reaching from wing to wing ; segments 9 and 10 have similar, similarly situated, but shorter ridges. Body surface as well as that of wings finely rugose. Colour yellowish-white, the ridges of abdomen and carination of thorax lined dark-brown ; the whole smudged with dirty markings. Apex of thorax is the highest point of pupa. L. 14mm. ; B. 4·5mm.

Egg.—Is semi-ellipsoid in shape, slightly broadened out at base ; the surface is covered with hexagonal cells with low, thin walls more or less obsoletely, the centre showing these cells in longitudinal rows formed by longitudinal ridges crossed by finer ones at right angles. Colour green-white, shiny, transparent looking. H. 0·9mm. ; B. 0·8mm.

Habits.—The egg is laid on the roots of dry bits of grass at the foot of the plant or on the underside of a blade. The larva lives on the underside of the blade or on the stalk and, when at rest, sits with its head turned round on its side ; when disturbed, rolls itself up and falls to the ground. Pupa is formed low down near the ground and is fixed to the underside of a blade of grass or to a stalk or other convenient object. It is firmly fixed but hangs free. The butterfly is confined to South India, the Nilgiris and the Wynaad. *Y. baldus*, F., is given as a species extending from the Himalayas to Bengal, Central, Western and Southern India ; Assam to Tenasserim. It is said to differ from *Y. philomela* in having the striæ coarser on the underside, chiefly. *Y. indecora*, Moore, is given as a race of *philomela* from the N.-W. Himalayas ; it is said to differ in its larger size. Our species has the habit of flying about in the mornings and afternoons over grass in a weak, jerky fluttering manner, settling often with its wings half opened to the sun on a dead leaf or the bare ground. It occurs in the jungles as well as in the open country, in the hills as well as on the sea-coast.

24. Ypthima asterope, *Klug.*—Male and female are dull brown on the *upperside* ; the cilia brownish-white. Forewing with the usual subapical ocellus ; in most specimens a pale ocellar area and a subterminal dark-brown band. Hindwing uniform with a single small subtornal ocellus. *Underside* greyish-white, covered with very delicate minute transverse striæ. Forewing with the ocellus as on the upperside, discal and subterminal dark-brown bands converging and meeting below the ocellus to form a loop. Hindwing more uniform with a preapical, a subtornal and a tornal comparatively small ocellus. Antennæ, head, thorax and abdomen dull brown ; abdomen greyish-white beneath. Exp. 36-44mm.

In the dry season the two sexes are like the above ; the *upperside* is slightly paler. *Underside* differs only in the ocelli on the hindwing being reduced to mere points or altogether absent. In some specimens an obscure discal sinuous transverse dark fascia on the hindwing ; and in all the dark-brown loop round the lower side of the ocellus as in the wet-season form.

Habits.—The transformations are unknown. The butterfly is found in the N.-W. Himalayas, the Punjab, Western and Central India and the Deccan, Burma, China on the east and Arabia, Nubia and Abyssinia on the west.

25. Ypthima huebneri, *Kirby.*—In the wet-season form the male and female *upperside* is greyish-brown. Forewing with the usual comparatively large, bipupilled, yellow-ringed, black preapical ocellus. Hindwing usually with two, sometimes with three, rarely without any, smaller similar unipupilled postdiscal ocelli. *Underside* greyish-white, not very closely covered with transverse short brown striæ. Forewing with the preapical ocellus as on the upperside, obscure discal and subterminal brown transverse fasciæ and a narrow brown ring round the ocellus diffusely produced posteriorly. Hindwing with one apical and typically three postdiscal posterior ocelli placed in a curve ; traces of transverse brown discal and subterminal fasciæ in most specimens. Antennæ, head, thorax and abdomen greyish-brown, the abdomen paler beneath. Male without secondary sex-mark.

The dry-season male and female are similar, somewhat paler on both sides ; the discal and subterminal transverse fasciæ more pronounced ; the ocelli on the underside of hindwing minute or absent. Exp. 40-44mm.

Habits.—The larva feeds upon grasses and is like that of *Y. philomela ;* the pupæ are also similar. The buttterfly is found throughout India, Burma and Tenasserim. It has just the same habits as *Y. philomela* and is found, like it, in dense jungle country and in open grass lands.

26. Ypthima ceylonica, *Hewitson.*—Male and female : *upperside* vandyke-brown to dark sepia-brown. Forewing uniform, with the usual single subapical ocellus. Hindwing : posterior half, sometimes less than half, pure white with two or three small posterior ocelli, a lunular, incomplete, subterminal and an even slender, terminal brown line. *Underside* white with somewhat sparse, short, delicate, fine, transverse brown striæ, getting denser towards the apex of the forewing. Forewing with the ocellus and a brown ring surrounding it very broad and very broadly and diffusely produced downwards, discal and subterminal fasciæ obscure. Hindwing with four ocelli in a curve, the anal bipupilled ; traces of a discal transverse brown fascia and of a lunular subterminal brown line. Antennæ, head, thorax and abdomen brown ; abdomen white beneath. Exp. 34-40mm.

Habits.—The butterfly has not been bred. It is found in Bengal, Orissa, South India, the Nilgiris, Travancore and Ceylon. Col. Bingham considers this a race of the preceding species.

27. Orsotriœna meda, *Fabr.* (Woodcut, Fig. 8). In the wet-season form the mall and female *upperside* is uniform vandyke-brown to blackish-brown. Forewing with a terminal, hindwing with a subterminal and terminal slender white line. *Underside* darker-brown : both wings with distinct subterminal and terminal slender lines as above ; a pure, white, straight, transverse, narrow, discal band attenuate at both ends and beyond it a line of white-centred, ochraceous and silvery-ringed black ocelli, two on the fore, three on the hindwing ; the apical ocellus on both wings the smallest, the apical two on hindwing, most often enclosed in the same inner and outer rings. Antennæ, head, thorax and abdomen brown ; antennæ speckled with white and ochraceous at apex. Exp. 44-51mm.

The dry-season form differs only in the ocelli and the subterminal and terminal lines, sometimes the transverse white band also, on the underside being obsolescent.

Habits.—The butterfly is the northern representative of the next species and exists in the Punjab, Dehra Dun, Oudh, Bengal, Sikhim, Central Provinces, Assam, Burma, Tenasserim, Andaman and Nicobar Islands, extending into the Malayan sub-region. The habits are the same as for the next species.

28. Orsotriœna mandata, *Moore.*—Differs from *O. meda* in the white discal band on the underside being very much broader and proportionately more attenuate apically. Often the apical ocellus on the underside of both wings is in the wet-season form smaller than in *O. meda*. Exp. 47-55mm.

Larva. (Pl. I, Fig. 1).—The shape of body is normal : spindle-shaped ; the anal segment with two long points, minutely haired, separated squarely at base and diverging, finely conical and as long as segments 12-14 together. The head is squarish, broader at jaws than at vertex, higher and broader than segment 2, with two divergent, fine, tapering horns, one on vertex of each lobe, as long as segments 2-4 together; surface of head is finely hairy, of horns tuberculate. Spiracles circular, small, inconspicuous, situated immediately above the white band, light brown in colour. Surface of body covered with minute hairs proceeding from transverse rows of small tubercles, one from each tubercle, giving the body the appearance of being transversely lined. The colour of the body and head is rose, the body lighter than the head; the latter with a dark red semi circular band on face; horns same colour as face with inner and outer side dark, this dark marking continued on to the head; body with a sub-spiracular white band and a lateral light line as well as a faint bluish dorsal line on the middle segments; ventrum dark-rose. L. 41 mm. over all, of which the horns are 5 mm., the tail-points 2·25 mm.; B. 4mm.

The colour is sometimes white green, yellowish on the sides with a dark bluish dorsal line and a similar lateral line on segments 2 to 4; tail-points and horns rose-coloured; head light dirty-yellow; the spiracles are light-brown.

Pupa. (Pl. I, fig. 1).—The pupa is somewhat boat-shaped though the thorax is humped and there is a considerable constriction, broad and not very shallow, behind it; the head, seen from above, is trapeze-shaped but has 2 long, sharp processes, triangular in section, closely applied against each other and only just separated at the points, directed straight out in a line with the ventral line of pupa; these processes are applied to each other along one angle, along which only they touch, one of the other edges of each is continued as a ridge on to the underside of the eye, the other as a ridge on to the top of the eye. Shoulders broader than segment 2 from where the lateral outlines of pupa diverge to segment 7, the wings are, therefore, slightly expanded; from segment 7 the abdomen, more or less circular in section, narrows gradually to end. The ventral line is straight. Thorax slightly carinated in dorsal line. Ventrum slightly flattened along centre, wing-surfaces flat. Cremaster short, square, strongly ridged dorsally and laterally and ventrally, each ridge ending in a sharp point posteriorly which points bear suspensory hairs. Spiracles oval, raised, light in colour, sometimes surrounded by a black border. Surface of body finely striated transversely, otherwise glabrous. Colour of body is a dirty-white: the colour of dead grass; with, occasionally, an iridescent golden gloss on the wings; lateral edges of wings (dorsal margins), ventral central line and head-process somewhat dark. L. 18 mm.; B. 5mm.; L. of head-process, 4 mm.

Habits.—The egg is laid on the underside of a blade of grass and the larva lives there, falling to the ground if alarmed. It is rather shy and not a great eater. The pupa is formed in an abnormal manner: the larva attaches itself, with its head pointing upwards, to a stalk, fixes its tail and then falls backwards so that the backs of segments 10 to 14 rest against the stalk, curving its head up forwards again so that its body takes the curves of the letter S. The pupa thus rests with its back against the surface very generally: in which particular (as well as in shape) it resembles *Discophora lepida* of the *Morphinæ.* The pupa is generally found low down near the earth, very often nearly touching the earth. The butterfly is confined to South India and Ceylon where it is generally found in the hills and jungles, but frequents rice-fields commonly where it occurs, and is probably the weakest flier of all the Satyrines it flutters very near to the ground and always settles with its wings closed.

29. **Elymnias undularis**, *Drury.*—Male: *upperside* blackish-brown. Forewing with a subterminal series of blue or sometimes slightly green elongate spots, curving strongly inwards and getting more elongate opposite apex, forming almost an oblique bar up to the costa. Hindwing: the terminal margin broadly bright chestnut, sometimes with a subterminal paler spot in two or more of the interspaces. *Underside* pale brown, the basal two-thirds of both wings densely, the outer third more sparsely covered with dark ferruginous, somewhat broad, transverse striæ. Forewing with a broadly triangular pale purplish-white preapical mark; both wings with a broad subterminal area purplish white. Hindwing with a small white spot opposite middle of the costa and a more or less complete series of more obscure whitish subterminal spots. Antennæ, head, thorax and abdomen brown; abdomen paler beneath. Female: *upperside* tawny, veins black. Forewing: the dorsal margin broadly black; the apical area beyond a line curving from the tornus round apex of cell and a little beyond it to the base of the costa, also black, the wing crossed preapically by a conspicuous, broad, oblique, white bar and three subterminal white spots. Hindwing: dorsal margin dusky; terminal broadly, costal margin more narrowly black; a subterminal series of four white spots. *Underside* tawny with markings similar to those in the male; the pale whitish markings more extensive; the dorsal margin broadly without striæ. Exp. 72-86mm.

Larva.—The larva is described by Moore as being "elongate, fusiform, setose; green with longitudinal dorsal and lateral yellow lines and a subdorsal row of yellow elongate spots centered with red and posteriorly edged with blue; head brownish, armed with two erect brownish setose processes: anal segment also with two red slender hindward projecting processes."

The pupa is "similar to *E. caudata.*"

Habits.—The habits of the insect in laying are not known but are not likely to be different from those of the succeeding species; those of the larva and pupa are also probably the same. The butterfly is distributed in the Himalayas from Mussoorie to Bhutan;

also in Lower Bengal, Central India; Assam to Tenasserim and into the Malayan Sub-region.

30. **Elymnias caudata**, *Butler.*—Male and female resemble *E. undularis*, but both sexes have the wings longer, proportionately to their breadth and the tail at apex of vein 4 of the hindwing longer. *Upperside*: male differs from *E. undularis* as follows:—The subterminal and preapical spots on the forewing white suffused slightly with dark scales; the terminal half of the hindwing tawny, more or less suffused with dusky black, which in some specimens forms a distinct border along termen. Female similar to the female of *E. undularis*, but the black more extended: veins 2, 3 and 4 on the hindwing broadly bordered with black. *Underside*: male differs from *E. undularis* in the more conspicuous broad white preapical triangular patch on the forewing and in the prominence of the broad tawny terminal half of the upperside of the hindwing which shows through a pale sometimes pinkish-brown, on the underside. Antennæ, head, thorax and abdomen brown, paler beneath and much paler in the female than in the male. Exp. 86-88 mm.

Larva (Pl. I., fig.-2).—Body spindle-shaped with a large squarish head and two quarter-inch long conical sharp processes or points on anal segment, directed straight backwards, slightly diverging and squarely separated at bases. The head is a good deal broader and higher than segment 2 and each lobe is surmounted by a blunt, cylindrical horn or process in the same plane as face, as long as the face is high, the pair separated squarely and widely at bases, slightly diverging and the extremity of each bears three sharp spines with another immediately below; between the horns, on vertex of head, are two short spines and five more in a row down each cheek: surface of the head is rugose being covered with small flat tubercles; the colour is dark chocolate with a broad central band down centre of face white, and a narrower one on each side of cheek also white; the central white band is crossed by two white lines diagonally, having their extremities near vertex and at base of face. The surface of the body as well as the tail-points are covered with small tubercles each bearing a short hair which has often a liquid globule at its tip. Colour of body is a very light bright emerald-green with a subdorsal line king's yellow and a lateral band of the same colour made up of triangles, one to each segment, the apex of the hinder triangle applied to the base of the preceding one, each triangle centred with red and sometimes bordered black above; a submarginal and marginal line of the same colour; there may be a lateral row of dark-green dots near hinder margin of each segment; they are generally obsolescent, especially on the hinder abdominal segments; anal points are reddish-yellow on top and black beneath. L. 55mm.; B. 6mm.; L. of tail-points 5mm.; of horns nearly 3mm.

Pupa. (Pl. I, Fig. 2*a*).—The shape recalls the pupa of *Lethe drypetis.* Head quadrate with two conical, round-topped, divergent, widely separated points directed straight out in front. Segment 2 is convex, keeled along the dorsal line. The thorax is convex, carinated in dorsal line, very high at apex, where the carina is developed into a blunt, laterally compressed point, the extremity of the point being perpendicularly over the segment-margin 2-3; the thorax is short, the dorsal line of the pupa from this point to front of head being nearly perpendicular to longitudinal axis. Wings expanded slightly parallel to the longitudinal axis of body so that the pupa is of the same breadth from shoulders to segment 8 ; the shoulders are angulate. Segment 4 carinated also in dorsal line slightly. Abdomen stout, transverse section from segment 6 to 13 is circular. Cremaster triangular, the extremity truncated, set with the preceding segment nearly at right angles to rest of pupa. The colour of pupa is bright velvety grass-green, carina on segments 2, 3 and 4 is yellow ; head-processes white with a dorsal black line ; just behind, on base of antenna is a dark rose-coloured short line surrounded by yellow with a small yellow spot in front of it ; apex of thoracic carina marked with rose on each side and there is a lateral spot, yellow touched with rose, on thorax ; dorsal margin of wings more or less broadly yellow ; the shoulders tipped rose ; about the centre of dorsal wing-margin is a rose line and a black mark with white centre outside it on segment 5 ; in the tornal angle of wing is a yellow blotch including a rose-coloured spot centred black with a white pupil ; segment 4 has a yellow rose-centred spot in its anterior angles ; there is a subdorsal row of rose and yellow spots on segments 6-10, that on segment 8 having a black centre ; a lateral spot, similar, on segments 8-10 ; on segment 13 a subdorsal spot on front margin, black and yellow ; two black spots at base of cremaster and one on each side of ventral line of segment 13. L. 22mm.; B. 6mm.; L. of head-points, included in total length about 1·5mm.

Habits.—The egg is laid on the underside of a leaf of a palm in a cool place, in the bed of a nalla or on the side of one, or in evergreen jungle for preference. The larva lies full-stretched on the underside of the leaf all its life with its ventrum closely applied to the surface. Owing to its bright colours it is not difficult to see. Before turning into a pupa it very often lies with its head turned round on its side and generally pupates on the last leaf it has been eating, on the underside, where the pupa is attached very firmly, sometimes fixed so that its longitudinal axis is parallel to the leaf surface, the cremaster being formed to help this in being longer at the extremity than broad, laterally compressed, that is ; the pupa is also a conspicuous object like the larva and would be very easy to find were it not that it is generally near the ground in a dark or very shady place on the underside of a drooping leaf. The butterfly frequents such places and is never found in the open, venturing at most on to the borders of small clearings in its native jungles. The male is fond of sitting on a leaf about ten or twelve feet off the ground, sunning itself in the chequered light that filters through the dense canopy overhead. It sits with its wings closed, very rarely partially opened, for a considerable period at a time and does not return constantly to the same place after a flight as do many species of Nymphalines. It is fairly strong on the wing and does not descend to the ground. The female is not often seen except when engaged in laying eggs. The distribution is South India from Travancore to Mysore and the Nilgiris but the insect is plentiful on the Belgaum ghats and probably further north. The larva feeds upon *Palmeæ* or Palms as Canes, Betel-nut or Supari Palm, the Fish-tailed or Sago Palm, the Wild Date, Cocoanut Palm, &c.

SUB-FAMILY—MORPHINÆ.

Genus —DISCOPHORA.

Males—	
A. Upperside purplish-brown suffused with indigo-blue towards the bases of the wings. Exp. 3·75″-3·5″	*celinde.*
B. Upperside brown, not suffused with blue.	
a. Upperside forewing with spots in two rows, anterior three of inner row blue, large, oblique. Exp. 3·1″-4″	*lepida.*
b. Upperside forewing in three or four transverse rows. Exp. 3·5″-4″	*tullia.*
Females—	
A. Upperside forewing with distinct, preapical, oblique, broad band.	
a. This preapical band ochraceous yellow	*celinde.*
b. This preapical band bluish-white	*lepida.*
B. Upperside forewing without distinct preapical band or at most the anterior spots of transverse discal series obliquely placed	*tullia.*

D. celinde is from "the Lower and Eastern Provinces of Bengal" in India, and from Sikhim, extending eastwards; *D. tullia* from Bengal and North Kanara, also extending eastwards from Sikhim; *D. lepida* only occurs in Southern India, but is found outside the limit in Ceylon. Mr. De Nicéville stated that *D. tullia* had been taken in Calcutta itself; but all three species are probably true jungle insects, keeping altogether to the hills though occurring there at elevations as low as 800 feet above sea level. It is certainly the case with *D. lepida.* The males of all three species have a sex-mark on the disc of the hindwing in the form of a large circular patch of specialised scales emitting a strong scent during life.

D. lepida was bred from the egg in North Kanara originally and, generally, during the monsoon months. All eggs came from one locality. Once, however, some young larvæ were found 40 miles away, further into the hills; these were kept and two pupated in the end. Of these one came to grief and the other produced a butterfly: a male. This male Mr. De Nicéville pronounced to be *D. indica*, a recognised variety of *D. tullia*. Now this insect was bred in the dry months of the year, about February, and is the only *Discophora* ever bred at that season. The larvæ and pupæ of this and *lepida* are very similar: but there was a slight difference of colouration. The occurrence has left a suspicion that *D. tullia* and *lepida* are really one and the same species, one the wet-season form (*lepida*), the other the dry-season form (*tullia*).

The *Morphinæ* form a small group of some 23 species in British India and have been divided into 11 genera, which shows what a heterogenous lot they must be. The genus *Morpho* is South American and contains in itself alone 50 species out of the 100 or so composing the whole sub-family; the other 50 being confined to the Indo-Malay region distributed among the above 11 genera. The sub-family is not represented in Africa, North America or Europe. *Clerome*, an Assam and Burmese genus, according to Col. Bingham, "all of which have vein 12 in the forewing inflated at the base, bear a close resemblance in appearance, mode of flight and habits to forms of the *Mycalesis* group" of the *Satyrinæ*. The pupæ of *Orsotriæna*, one of the *Mycalesis* group, and *Discophora* are surprisingly similar in shape though quite unlike any other satyrine chrysalis and are peculiar in the unique habit of suspending themselves against a perpendicular surface with their backs to it; the larvæ of *Discophora* have more affinity with *Satyrinæ* than with *Nymphalinæ* in shape, and both eat monocotyledonous bamboos. The imagines resemble those of the Satyrines also in their aversion to strong light and open spaces; they are, indeed, crepuscular, hiding in dark places during the daytime to come out only at sunset, never earlier. They are very strong, active fliers and keep on the wing for hours together, generally, however sticking to one beat in which they fly backwards and forwards. At least these are the habits of the male. The females are much more rarely seen and are then always flying close to the ground round bamboo clumps or among bamboos in thick places in the dusk. The style of flight is satyrine: series of jerks from the wings being brought together over the back between each jerk. The insects always rest with their wings closed and are not seen at flowers. They suck up sap from wounds on trees. The eggs are laid on the undersides of bamboo leaves and, in the case of *Discophora*, in batches of from 3 to a dozen in rows. The larvæ, when first they emerge, are as hairy as any moth caterpillar and live in company until nearly full grown. The food plant is Bamboos or Palms (*Amathusia*).

The morphine larva is, as far as is known, more or less cylindrical in shape, has the head round and thick, in some cases (*Amathusia*) with palmated lateral processes, sometimes smooth, the last segment of the body ending in two well separated points, short and fleshy in *Discophora*. The body is covered sparsely with long, fine hairs, longest near head and anal extremity but not enough to hide the surface in the least. The pupa is boat-shaped, smooth as to surface, the front produced out into a long process consisting of two closely applied long fine cones. As already stated the chrysalis is often attached to a perpendicular surface, with its back towards it. The colour of the caterpillars known is brown or blackish-grey with, in *Discophora*, a white or light dorsal band and some red, yellow or black marks. The colour of the chrysalis is either green or pinkish bone-colour according as it is formed amongst green leaves or dead leaves.

The morphine egg is "somewhat similar to that of the *Satyrinæ*, but comparatively flat, not so high in proportion to width 'translucent hard, smooth (*Discophora*, *Thaumantis*), or obscurely facetted (*Clerome*),' (Doherty)." That of *Discophora lepida* is flattened spherically in shape, slightly shiny as to surface, looking as if it were pitted extremely minutely all over, greyish-white in colour and of ordinary size. Sometimes also, in this species, there are signs of fluff from the abdomen of the butterfly among the eggs of a batch.

DESCRIPTION OF SPECIES OF MORPHINÆ.

31. **Discophora celinde**, *Stoll.*—Male: *upperside* purplish-brown, the basal four-fifths of both fore and hindwing suffused with dark indigo-blue. Forewing with two obliquely placed preapical pale ochraceous-white spots, and a series of four or five subterminal similar spots. Hindwing uniform except for the dark sex-mark on the disc. *Underside* ochraceous shaded with brown,

darkest on the outer half of the hindwing; a broad dark-brown discal fascia across both wings from costa of forewing to tornus of the hindwing; beyond this a lighter ochraceous band, followed on the hindwing by obscure ocelli in interspaces 2 and 6 and a purplish-white diffused mark at the tornus. Female: *upperside* paler purplish brown, the terminal margins of the wings narrowly and evenly yellow, a broad yellow-oblique preapical bar on the forewing, curving downwards and ending in two or three detached triangular spots, two discal spots below middle of bar and an outer series of three subterminal large lunular spots. Hindwing on its anterior half outwardly with some diffuse yellow obscure spots. *Underside* similar to that of the male but much lighter and brighter ochraceous, the brown shading forming obscure transverse bands of which the discal, broad postdiscal and subterminal crossing both wings are the most prominent; an additional ocellus in interspace 3. Antennæ ochraceous; head, thorax and abdomen brown above, more or less ochraceous beneath. Exp. 95-99 mm.

Larva.—Anal segment with two slender processes; each segment with dorsal and lateral tubercles studded with tufts of hair; head black; body brown with paler longitudinal dorsal and lateral bands, a short black line on each side of the dorsal line anteriorly on each segment; legs with a spot of dark-red on each.

Pupa.—Boat-shaped, broad across the middle; head piece prolonged and acuminated into a bifid point; colour pale purpurascent-brown.

These descriptions of larva and pupa are taken from Col. Bingham's book.

Habits.—The habits are sure to be very similar to those of *D. lepida* as regards all the stages. The insect is found in Sikhim, the Lower and Eastern Provinces of Bengal, Assam, Burma, Tenasserim extending to the Malay Peninsula.

32. **Discophora lepida**, *Moore.*—Male and female resemble *D. celinde*, but in the male the ground-colour on the upperside is dark velvety-brown without any blue reflections; the forewing is crossed preapically by three obliquely-placed, comparatively large pale-blue spots with an ill-defined series of three or four much smaller subterminal spots; in the female the markings, though similar to those in female *D. celinde*, are on the upperside of the forewing all pale-blue, not yellow, and more numerous, larger and better defined on the upperside of the hindwing. *Underside*: Male: similar to that in male *D. celinde*, but a more or less prominent diffuse subterminal band irrorated with lilac scales crosses both wings. Female similar to the female of D. *celinde*, but much paler Exp. 80-104mm.

Larva (Pl. I, fig. 3).—In the first stage, immediately after emerging from the egg the head is black and round, the body is cylindrical with tiny tail-points; colour of body brown-yellow with indistinct row of lateral black spots, one to each segment. Body covered with long soft white curved hair like any young eupterotid moth.

2nd stage.—Head black as in last. Body yellow with lateral row of black spots; bases of the legs red; hairs longer even than in the 1st stage, of the same colour.

3rd stage.—Head black. A broad dorsal yellow band with dark central line, flanked by a dorso-lateral black band; colour yellow-grey on dorsum changing to grey on sides; a black lateral spot on each segment 6-12; base of legs red. Body covered with long, light, fine hairs, more or less erect all over, longest on dorsum.

4th stage.—The head is black with the clypeus white and a white patch on the vertex of each lobe; otherwise everything the same as in the last stage.

5th stage.—Head pear-shaped, *i e.*, narrower at vertex than at base, as broad as high, thick, covered with long hairs of different lengths except the clypeus which is naked, all growing perpendicular to the surface which is smooth and dull; colour of head black, spotted finely with yellow with a large light brown patch on vertex of each lobe; clypeus yellow-brown bordered narrowly with black and, again, with white outside that broadly; lower part of face light-brown. Body cylindrical in shape, broadest and highest slightly at middle, segment 2 narrower a good deal than the head; the last segment rounded at extremity, in a plane nearly perpendicular to longitudinal axis of larva, ending in two short, strong, conical, widely and squarely separated, divergent points, light yellow in colour and moderately densely set with light-coloured hairs. Spiracles rather small, conspicuous, longly oval, white, bordered thinly black. Surface of body dull, smooth except for a clothing of moderately sparse, longish, reddish-yellow hairs with some very long dark-brown white-tipped hairs to each segment; all hairs erect, most numerous at the two extremities of body, especially at the 2-4th segments. Colour of body bluish-grey suffused with blackish dorsally, with a pure white, broad dorsal band the whole length of body, flanked on each segment by two more or less distinct marks on each side on each segment; there is a long lateral vermilion mark on each segment 6-11 being parts of an interrupted lateral band, the parts between the vermilion marks being indicated by light-yellow streaks; a black speckling in spiracular region, a black band above base of true legs; a whitish band above base of pseudo-legs; all legs brown-red in colour, their bases densely haired. L. 59mm; B. 9mm.

Pupa (Pl. I, fig. 3*a*).—Is the shape of that of *Orsotriona mandata.* Head rather small, trapezoid in shape, running out evenly into two long, pointed, conical, contiguous, transversely striated processes, directed straight forwards, slightly downwards, often slightly separated at base and tip. Segment 2 in a piece with head: broad; the dorsal line in the same plane as that of head and front slope of thorax; broadening out to shoulders. Thorax slightly humped, convex, slightly carinated in dorsal line. Wings expanded evenly and in a slight convex curve making the body broadest at segment 7 where it is also highest; the dorso-ventral edge of body along wings is sharp. Constriction broad and shallow dorsally, nothing laterally. Abdomen strongly curved dorsally from segment 7 to end, transverse section of the part circular. The pupa decreases gradually in diameter from segment 7 to end; ventral line straight, cremaster inclined to it, triangular, truncated, slightly bifid at extremity, stout, with two strong, rugose, ventral extensor ridges, each ridge knobbed at both ends; suspensory hairs at extremity in a dense tuft. Spiracles oval, of moderate size, colour of the body with a linearly oval white centre. Body surface shiny, finely and irregularly rugose under lens. Colour when formed among green leaves is a rich shiny green with the head-points, cremaster and dorsal wing-margin orange-yellow. When formed among dry leaves the colour is that of a clean fresh bone: pinkish dirty white with a faint dorsal flesh-coloured line; wing-veins also flesh-coloured; some blurred dirty blotches laterally on thorax and first abdominal segments; dorsal wing-margin light yellow-brown, head process pinkish yellow; the whole with minute black spots. L. 41mm., of which head-process 6mm.; B. 13·5mm. at segment 7 where the H. is 12·5mm.

Habits.—The eggs are laid along the midrib of the blade on the underside in rows when more than four or five: sometimes as many as 15 together. The little larvæ emerge and live together, looking like a patch of whitish woolly hair; and they live like this until the last moult, when each goes its own way. Then each larva lives on top of a bamboo-leaf, coating it all over with silk and drawing one or two others over it, thus forming a cell; sometimes among a collection of dead leaves, amongst the green ones or along the stems of the bamboos. The larva is restless, wanders a good deal, making several cells during its life-time: and wanders often a long way before pupating. The position chosen for the change is generally somewhere right in the interior of a bamboo-clump fairly near the ground, or among dead leaves or rubbish where the larva often fixes its tail in a pad made on a perpendicular stalk or stem, lying with its head up stem; it becomes dirty-whitish in colour, falls over backwards and in that position changes to a pupa, which is a proceeding known only besides in the genus *Orsotriœna* of the *Satyrinæ*. Ten young larvæ were found on the 17th of May. They moulted on the 22nd; again on the 26th and for the 5th time on the 1st of June; they began to pupate on the 11th and the first butterfly came out on the 22nd. This would mean that the larva at this particular time of year requires one month to complete its growth and that the pupa stage lasts about 11 days, most probably 10·5 days or a week and a half. The places where the eggs are laid are generally the beds of cool nallas or on the outskirts of evergreen jungles, in fact in any cool, fairly moist place. Here the butterflies are also to be found at sunset and for some time after flying up and down the bamboo glades as already mentioned once or twice before. The species is confined to South India and Ceylon.

33. **Discophora tullia,** *Cramer.*—Male: *upperside* dark-brown. Forewing with transverse discal, postdiscal and subterminal spots, the latter two series closely approximate. Hindwing uniform except for the prominence of the black sex-mark and faint indications of a subterminal series of spots. *Underside* dull ochraceous brown, the basal half of the wing darker, defined outwardly by a still darker but obscure transverse band ending in a lilacine diffuse small patch on the tornus of hindwing; both fore and hindwing irrorated somewhat sparsely with short transverse brown striæ and obscurely tinted with lilac; two ill-defined ocelli on the hindwing as in *D. celinde.* Antennæ ochreous; head thorax and abdomen brown, paler beneath. Female: *upperside* purplish-brown. Forewing with three transverse series of white spots, the inner or discal series continued to the costa by two large elongate obliquely-placed white spots. Hindwing also with three transverse rows of somewhat obscure spots, but ochraceous in colour. *Underside* similar to that in the male, but pale. Exp. 90-102mm.

Larva.—On bamboo, living during the day in three or four leaves spun together . . . . full-fed larva 2 inches long, colour black mottled with grey; a rather broad yellowish dorsal line; the junction of the segments marked by a thin, irregular yellow line and red spot; body covered with white hairs: head and anal end black; the former marked with perpendicular yellow lines.

Pupa.—Pupa white, suspended by the tail; the labial palpi prominently projected; changed to dark-brown a few hours before emergence. The perfect insect remains three weeks in the pupa.

This description of the caterpillar and chrysalis was written by Manders and has been taken from Col. Bingham's book.

Habits.—The insect is found in Kanara in South India, in Bengal, in Sikhim, Bhutan, through Assam, Burma and Tenasserim to the Malay Peninsula and was described originally from China. Three species have been made out of the one at different times owing to its variability. The *larva* of the variety *D. indica,* Staudinger, bred in Kanara was similar in shape to that of *D. lepida.* Head semi-elliptical as seen from in front; clypeus black with central white line; bordered all round yellowish; a narrow yellow line from over vertex of head down the middle; eyes black; a bunch of long porrect hairs on top of each lobe of head, thin, light, not hiding surface in any way; similar porrect hairs disposed on both cheeks ; colour of head red-brown appearing lighter on vertex of each lobe because of the bunches of hair ; surface dull. Spiracles oval, black, with white centres. Surface of body dull, covered moderately densely with longish erect hairs of which some few laterally are longer than others ; there is a subdorsal bunch of stiffer hairs on segments 3-6 making these segments look brown over dorsum ; other hairs are light mouse-coloured. Anal flap broadly rounded at extremity, the two anal processes are short, conical, light-yellow and hairy. Colour of body light brownish-greyish with a thin subdorsal line white ; each segment with a dorso-lateral black mark near front margin distinct on segments 2-7 ; behind these black marks on segments 2-13 a light chocolate-brown mark : legs rose-coloured. Size somewhat smaller than *D. lepida*. The *pupa* is very like that of *D. lepida*, only differing in being smaller than the majority of pupæ of that species. The colour is either green or bone-coloured ; when the latter it is generally without the black powdering of *D. lepida*. It will suspend itself backwards like the pupa of *D. lepida*, that is as often as that species, against a perpendicular surface ; when the pupation takes place on a horizontal surface the pupa hangs quite free by the tail and rather loosely : as is also the case with *D. lepida*.

[NOTE.—With this paper is published coloured Plate F, which includes *Abisara echerius*, Stoll., and *Eyolis ariadne*, Johannson, which will be treated of later on. *Melanitis ismene*, Cramer, is figured on Plate D which will be published later on.]

PLANTS GATHERED IN AND ABOUT MUSSOORIE DURING 1908.

By

James Marten.

I.—RANUNCULACEÆ.

Clematis montana.	Is fairly common and blooms during April.
Clematis Buchananiana.	Is very common ; begins to bloom in September and lasts a long time.
Anemone ricularis.	Is very common ; blooms in September.
Thalictrum foliolosum.	Very common plant ; blooms about July.
Delphinium denundatum.	Not common ; blooms July-August.

II.—BERBERRIDACEÆ.

Berberis aristata.	An extremely common shrub ; blooms May-June, fruit ripens July-August, is of a pleasant sub-acid flavour and is greedily eaten by the natives. The wood is bright yellow and is brought in by wood cutters and sold as firewood.
Berberis nepalensis.	A handsome small tree with bright green imparipinnate leaves and yellow flowers in erect racemes ; the berries are elliptic, bright purple and covered with a glaucus bloom. The roots of these and other varieties are sold by the hill men under the common name of " Rasaut".

III —CRUCIFERÆ.

Nasturtium officinale.	Common in most streams.
Arabis Alpina.	Occurs, but not frequently met with, in and close to the station.
Caspella Bursa-pastoris.	A common weed, flowers here in April.

IV.—VIOLACEÆ.

Viola canescens.	Common everywhere.

V.—POLYGALACEÆ.

Polygala crotalariodes.	Growing on rocks.

VI.—CARYOPHYLLACEÆ.

Gypsophila cerastiodes.	In bloom May, June, July.

Lychnis nutans.	Throughout the rainy season.
Stellaria media.	A common weed; flowers during the rains. Canaries are fond of this Chickweed.

VII.—HYPERICACEÆ.

Hypericum patulum.	Common along all road sides and blooms more or less throughout the summer and wet months.
Hypericum elodeoides.	Found 1st September in full bloom.

VIII.—MALVACEÆ.

Malva rotundifolia.	Very common, found it in flower in June and again in August.
Sida humilis.	Found on cart road below 5,000 feet, not in flower in August.
Thespesia lampas.	Found in warm valleys during the rains, bears large bright yellow hibiscus-like flowers with a dark crimson centre, a plant well worthy of cultivating in hedges.
Bombax malabaricum.	The silk cotton tree occurs in the lower valleys.

IX.—TILIACEÆ.

Grewia oppositifolia.	Common on the lower hills and warm valleys; the leaves are lopped and stored for fodder for winter use; the bark yields a strong fibre; it saponifies when rubbed and agitated in water and is used in this state as a hair wash by the hill people.

X.—LINIACEÆ.

Reinwardtia trigyna.	Common in the lower hills and along streams.

XI.—GERANIACEÆ.

Geranium nepalense.	Common everywhere, blossoming throughout the rains.
Geranium wallichianum.	Flowers in September.
Oxalis corniculata.	With yellow flowers.
Oxalis acetosella.	With purplish-pink flowers, are very common weeds and are a perfect pest in our gardens.
Impatiens balsamina.	Flowers, light pink, in bloom now—August.
Impatiens scabrida.	Flowers yellow brown, spotted.

XII.—RUTACEÆ.

Boenninghausenia albiflora.	Commonly known as the bug or flea plant; very common; flowers in August.
Zantoxylum alatum.	Called by the natives "Tej-bal." The wood which is armed with strong blunt prickles is extensively used for walking sticks, also for other ornamental purposes, *ex. gr.*, picture frames, the edgings of brackets, tea trays, &c.
Murraya kœnigii.	Common in warm valleys; the aromatic leaves are used as a condiment and are sold in the bazaars under the name of "Kári-pát."
Cedrela serrata.	In most of the warmer parts. Flowers May to June.

XIII.—AQUIFOLIACEÆ.

Ilex dipyrena.	The common Himalayan holly, flowers April, May and June, fruit ripens in October and November.

XIV.—RHAMNEÆ.

Zizyphus oxyphylla.	Common in waste lands and near villages. The fruit is subacid and is eaten.

XV.—VITACEÆ.

Vitis himalayana.	A very common extensive climber; the foliage turns red in the autumn and lends a rich colouring to that of the tree it grows upon.
Vitis parvifolia.	Grows on rocks and trees, flowers April.

XVI.—SAPINDACEÆ.

Æsculus indica.	Abundant; flowers about April, fruit ripens during October. The wood is used by turners and is made into cups, vases, platters, &c. In Chamba the fruit is soaked for several days, the husk removed and the embryo thus removed of its bitter principle is ground and mixed with flour for food. It is considered a relish by the hill people.
Acer oblongum.	Is the only maple I have found at Mussoorie in flower in March, the winged fruit remains long on the tree.

XVII.—ANACARDIACEÆ

Rhus cotinus.	Occurs in most valleys; it blooms March and April, when one may see its panicles of pretty purple flowers hawked about the Mall for sale.

The wood is very pretty, being of a bright yellow with brown veins; it makes very pretty picture frames.

Rhus paviflora. Is not, so far as my knowledge goes, found in the immediate vicinity of Mussoorie, but I have come across it in the Aglar Valley and along it to its junction with the Jumna River.

Pistacia integerrima. This handsome tree was once very plentiful near villages on the lower hills about Mussoorie and across the Song River opposite Rajpur, but unfortunately owing to its value as a charcoal wood it is now all but extinct.

It is far and away the prettiest of our Indian woods. The heart wood is beautifully mottled with yellow and brown streaks, is hard and durable and takes a high polish.

The tree produces horn shaped galls which are collected and sold in the bazaars under the name of "Kakar singi."

Odina wodier. Found on the lower slopes; flowers during March and April. A handsome spreading tree, the branches are extensively lopped for fodder and from incisions on the trunk a gum used by dyers exudes and is collected and sold.

XVIII.—CORIARIACEÆ.

Coriaria nepalensis. Common at Mussoorie; flowers April; fruit ripens in June; is eaten by the hill people.

The wood is very hard, of a grey colour and often beautifully mottled and makes pretty frames.

XIX.—LEGUMINOSÆ.

Crotalaria albida and C. sessiliflora. I have found both near cultivation below Mussoorie; flower during the rainy season.

Trifolium repens. Clover. Very common; flowers in rains and well into Autumn.

Indigofera atropurpurea. Is the commonest of the wild Indigo species up here. It flowers during June and July, the flower buds which are subacid are plucked and eaten by the natives.

Astragalus leucocephalus. Common on the south face of the hills. Flowers in May when it looks very pretty with its pale yellow flowers lying against the silvery white leaflets.

Lespedeza sericea	Met with along the Rajpur road; flowers about June.
Uraria neglecta.	Found on the cart road in flower during August.
Ougeinia dalbergioides.	Found on the cart road; it occurs largely on the outer slopes. The tree comes into bloom about March, and just before the new leaves appear, when it affords a very pleasing sight. The wood is strong and durable and is in great demand.
Desmodium tiliæfolium.	Grows plentifully at Mussoorie: flowers towards end of the rainy season when the shrub looks very pretty.
Vicia rigidula.	Found on the grass slopes; flowers about August and September.
Erythrina suberosa.	Lower hills below Mussoorie. The tree is a lovely sight when in flower during March-April.
Butea frondosa.	Lower hills below Mussoorie. The tree is a lovely sight when in flower during March-April.
Pueraria tuberosa.	Found on the cart road below Bhatta village; flowers during April: the juicy tubers are eaten by the natives during the hot season and are considered cooling and refreshing.
Phaseolus trilobus	Flowers during September and October.
Vigna vexillata.	Trailing on grassy slopes: flowers during September.
Atylosia scarabæoides.	Is very common: in flower August and September.
Rhynchosia himalensis	Flowers early in August.
Flemingia vestita.	Growing on grassy slopes: flowers in September.
Cassia tora.	On cart road: flowers during the rains.
Cæsalpinia sp.	Found in damp localities in the lower valleys; in fruit during September.
Bauhinia vahlii.	In most valleys, a large climber, in favourable localities attaining a great length reaching to the tops of the highest trees and spreading from tree to tree, thus doing considerable damage to Forests where it occurs. It sometimes attains a great girth, being several feet in girth. It is of great value to the agricultural classes yielding a coarse but very strong fibre for ropes. The leaves are gathered and sold for platters, &c.

Bauhinia retusa.	Occurs between Rájpur and Jherripáni, where the trees are seen with their trunks much disfigured by excessive tapping for its gum. "Semru" or "Semla" "gond" not unlike gum Arabic and used largely in medicine.
Mimosa rubicaulis.	All along the lower slopes of the hills up to about 4,000 feet.
Acacia Instia.	Is the only one of this family I have met with in these hills and it occurs only in the lower hills below 4,000 feet, appears to flower throughout the summer.
Albizzia mollis.	One tree close to the spring on the Spring Road: flowers in June.

XX.—ROSACEÆ.

Prunus puddum.	The wild cherry is fairly common at Mussoorie, flowers here during November; fruit ripens the following April, of a pleasant bitter sweet taste, makes a good cherry brandy. The wood is used for walking sticks.
Prunus armeniaca.	The apricot, largely cultivated by the village people and Europeans.
Prinsepia utilis.	The "Bhekar" of the hill men is found in all open warm places; flowers during the rainy months. The kernels yield an oil used for burning.
Rubus paniculatus.	This larger rambling climber is met with in all shady jungles, the fruit which is a large black or dark purple dupe is collected and brought into the station for sale, is sweet and palatable and makes an excellent jam. Flowers April, fruits in June and July.
Rubus macilentus.	A trailing shrub armed with flattish prickles, is common; flowers in April; fruit ripens in June or July; is edible.
Rubus ellipticus.	The "hinsar" or "anchu," a large shrub with stout branches armed with very sharp prickles, is very common. The yellow raspberry flavoured fruit is very palatable.
Rubus biflorus.	A large spreading shrub, branches covered with a greenish white powdery bloom and recurved sharp

	prickles ; flowers during April or May ; fruit ripens about June ; it is sweet and is eaten.
Rubus lasiocarpus.	A spreading shrub, branches purple, pendulus and often rooting at apex, armed with few small prickles, flowers dark pink, fruit dark red black when fully ripe ; flowers early in the hot weather ; fruit ripens about May ; it is sweet and palatable.
Fragaria indica *Fragaria vesca.*	Both these Strawberries are met with at Mussoorie; flower during rainy season ; fruit ripens in September.
Potentilla argyrophylla.	Found on road to Municipal gardens : in flower in September.
Agrimonia eupatorium.	Common ; flowers August and September.
Rosa moschata.	A pretty climbing rose ; it comes into flower in April and remains in bloom for about three months. The white sweet scented petals gathered by the natives and rubbed up with sugar, constitute conserve of roses " gulkand ".
Rosa sericea.	Occurs at Landaur on the Upper Circular Road ; is not very common ; it appears to love shade ; flowers in June.
Rosa macrophylla.	Frequently met with ; it is an erect shrub with smooth green branches with straight prickles. The bark peels off in long thin strips ; flowers in May ; in fruit during September.
Pyrus pashia.	The common medlar. It flowers during March and ripens its fruit in November-December. The fruit is eaten when over-ripe, in which state it tastes like jam. The wood is compact and fine grained and takes a high polish and is much sought after for walking sticks. The stools of younger trees form very hardy stocks for budding English and other varieties of pears upon. A friend of mine exports seeds of the tree to Australia for this purpose.
Pyrus lanata.	At Jabar-khet (Landaur) : flowers during April ; in fruit in August.

Pyrus foliolosa.	At Jabar-khet (Landaur); flowers during April: in fruit in August; the bloom covered red fruit in September looks very pretty.
Cratægus crenulata.	The Hawthorn, is common. It blooms in April: fruit an orange-red dry drupe containing five triangular one-seeded nutlets, ripens in the cold weather. The vernacular name is "ghingaru" and the fruit is eaten and the straight spiny branches are in great demand here for walking sticks.
Cotoneaster bacillaris.	The "Rauns" or "Ruinsh" is common in most shaded localities, the wood is white and very hard and is much sought after for walking and "Khud" sticks and in consequence one never meets with a tree that has not been repeatedly cut and mutilated: flowers in April-May; the fruit ripening in July.
Cotoneaster microphylla.	A much-branched prostrate evergreen shrub, met with everywhere, growing against rocks and banks: flowers in April-May: fruit August-September.

XXI.—SAXIFRAGEÆ.

Saxifraga ciliata.	Is very common on rocks about Mussoorie, attaining quite a large size in favourable situations, bears pretty pink flowers during March.
Saxifraga diversifolia.	Is less common: it blooms in September and bears pretty yellow flowers.
Parnassia nubicola.	Not common, it blooms here in September.
Deutzia staminea.	Blooms in April and May and makes a great show with its pannicles of waxy-white flowers.

XXII.—CRASSULACEÆ.

Kalanchoe spathulata.	Growing in rocky ground on the road up from Rajpur; not found much above 4,000 feet: flowers during the rains.
Sedum trifidum.	Is common on trees and rocks: flowers during the rains.
Sedum rosulatum.	On rocks: flowers early in May.

XXIII.—LYTHRACEÆ.

Woodfordia floribunda.	Common in the Valleys below Mussoorie. Flowers at the beginning of the hot weather. The flowers secrete honey. They are collected and exported under the name of "Dhawai" to the Punjab for dyeing silk.

XXIV.—ONAGRACEÆ.	
Epilobium roylеanum.	Not common ; it flowers in August.
Œnothera sp.	A common weed, appears to flower throughout the Summer and Rains.
XXV.—CUCURBITACEÆ.	
Zehneria umbellata.	Flowers in June ; in fruit in September.
XXVI.—BEGONIACEÆ.	
Begonia picta and Begonia amœna.	Are very common, found growing on rocks and banks ; flower during July, August and September.
XXVII.—FICOIDEÆ.	
Mollugo stricta.	Common : flowers in August.
XXVIII.—UMBELLIFERÆ.	
Pimpinella diversifolia.	Common : blooms in July and August.
Heracleum canescens.	Common in all shady localities : it blooms in September.
Heracleum candicans.	This large leaved variety is also very common ; blooms in April and May and again in September.
XXIX.—ARALIACEÆ.	
Aralia cachemirica.	Occurs but is not very common. Flowers in August and September.
Hedera helix.	The Ivy is very common, clinging to trees and rocks by its bunches of adhesive rootlets.
XXX.—CORNACEÆ.	
Cornus capitata.	Vernacular " bhamora ". Flowers during the summer ; fruit ripens in November and December : is red when quite ripe and is edible.
Cornus macrophylla.	Grows into quite a moderate sized tree. Flowers April and May, fruit ripens in September, October. The leaves are lopped for fodder, the fruit is eaten. Vernacular " Kagshi ".
Cornus oblonga.	Flowers during the rains. Fruit ripens in cold weather.

XXXI.—CAPRIFOLIACEÆ.

Viburnum cotinifolium.	Flowers during April; fruit ripens in July. The wood is white, is tough and elastic. The fruit is sweetish and is edible.
Lonicera quinquelocularis.	This honey-suckle is very common at Mussoorie; it bears during April pale yellow scented flowers.
Abelia triflora.	Common; flowers during the rains; branches are lopped for fodder. Vernacular "Male."

XXXII.—RUBIACEÆ.

Argostemma verticillatum.	Found growing on damp rocks on road from Rajpur below Jherripani; flowers in August.
Leptodermis lanceolata.	Very common; growing on rocks along road sides: bears large panicles of pinkish white flowers, the leaves when crushed emit a very fetid and offensive odour. Vernacular "padera".
Rubia cordifolia.	This trailing plant is common; the root known by the name "Manjit" is dug up and sold for the red dye it yields; flowers during the rains.
Galium acutum and *Galium rotundifolium.*	Are common road side plants: in flower during the rains.

XXXIII.—DIPSACEÆ.

Dipsacus inermis.	Common; flowers during September and October.

XXXIV.—COMPOSITÆ.

Aster asperulus.	Is the only variety I have so far collected. It comes into flower in September and is fairly common.
Solidago virga-aurea.	Flowers towards the end of September.
Myriactis wallichii.	Is very common; flowers in June and remains long in bloom.
Dichrocephala latifolia	Common; found in flower in October.
Laggera alata.	Common; flowers late in September and October.
Gnaphalium hypoleucum and *Gnaphalium luteo-album.*	Common plants; flower during the rains.
Inula cuspidata.	Common; flowers in September, the root is used in the preparation of "Sur" by the hill people.

Eclipta erecta.	In fields about villages below Mussoorie; all parts of this plant are medicinal. Vernacular "Bhangra".
Galinsoga parviflora.	A very common weed; flowers in the rains.
Bidens pilosa and *Bidens wallichii.*	Both very common; plants flower September and October.
Artemisia vestita.	Is very common; flowers during the rains.
Serratula pallida.	Is very common and flowers in the rains.
Gerbera lanuginosa.	Grows everywhere; abundant on rocks and old walls. The white coating on the under side of the leaves "eupphi" or "kapas" is collected by the paharis as tinder for flint and steel.
Echinops sp.	Not yet found in flower.
Ainsliæa aptera.	On road to Municipal gardens; flowers before the rains.
Crepis fœtida.	Common in fields below Mussoorie; in flower throughout the summer months.
Crepis japonica.	On Vincent's Hill north slope above Municipal gardens.
Lactuca scariola.	Common everywhere; flowers August-September.
Lactuca macrorhiza.	Common; growing on rocks and old walls: flowers throughout the summer and wet months.
Prenanthes brunoniana.	Common in shaded localities; flowers September.
Sonchus oleraceus.	Very common; flowers in September and October.

XXXV.—CAMPANULACEÆ.

Campanula colorata.	A common road side plant; flowers throughout the summer and wet months.
Campanula argyrotricha.	Found on rocks; flowers in September.

XXXVI.—ERICACEÆ.

Andromeda ovalifolia.	Found in Mussoorie in forests but is not common. Vernacular name "Aiyar" or "Ainyar"; the leaves of this tree are considered poisonous to goats: flowers here in April.

Rhododendron arboreum.	Common and associated generally with the oak (*Quercus incana*). It flowers in March and April when it bears large crimson showy flowers which make an excellent jelly. Vernacular name "Buras."

XXXVII.—PRIMULACEÆ.

Androsace lanuginosa.	Common : growing on rocks and banks. Flowers April to July.

XXXVII (*a*).—STYRACEÆ.

Symplocos cratægoides.	Found growing at Landour. Common in fruit in October. The bark is used as a dye. Vernacular "Lodh." Leaves are lopped for fodder.

XXXVIII.—OLEACEÆ.

Jasminum dispermum.	Growing near the Brewery. Flowers in hot weather.
Jasminum humile.	A scandent or half erect shrub with dark green foliage and yellow flowers : blooms during the rains.
Ligustrum compactum.	Found on Vincent's Hill, flowers in September-October.

XXXIX.—APOCYNACEÆ.

Carissa carandas.	Valleys below Mussoorie ; blooms in winter and summer months ; the fruit is black when quite ripe ; is sweet and is eaten. The shrub is cut and used for fencing fields. A variety bearing large fruit is extensively cultivated in gardens on the plains, the fruit of which is greatly esteemed. Vernacular "Karaonda."
Holarrhena antidysenterica.	Common in lower valleys below Mussoorie. It bears in the hot weather large cymes of sweet-scented white flowers, the bark is very bitter and is used for dysentery whence its specific name. The seeds too are bitter and are sold under the name of "Talkh indarjan" and are used medicinally.

XL.—ASCLEPIADACEÆ.

Dœmia extensa.	This climber is found in the warm valleys below Mussoorie. I found it in flower about the end of March above Rajpur. The flowers emit a high, somewhat disagreeable odour.

Cynanchum dalhousiæ.	A twining rather hairy shrub ; flowers in August.
Marsdenia roylei.	A large twining plant, juice milky. Flowers here in July-August. Fruit in September.
Marsdenia tenacissima.	Does not ascend much above 3,000 feet, but is common everywhere along the foot of the hills. The Khair Forests in the Dun are full of it. From the bark of this plant the "Gurkhás" obtain a fine silky fibre which they spin and plait or twist into very strong fishing lines : vernacular name "Marwa."

L.—LOGANIACEÆ.

Buddleia paniculata.	Found on cart road at about 5,000 feet, probably occurs higher ; in flower during April.
Gardneria angustifolia.	A scrambling or scandent shrub, does not appear to be common up here, as, so far I have met with one plant only. Flowers here in June.

LI.—GENTIANACEÆ.

Exacum tetragonum.	Common ; flowers during the rains.
Gentiana kurroo.	This handsome plant is found in one locality only up here on Miss Swetenham's Estate. The hill and one of her houses being named after it. Flowers here about October.
Gentiana argentea.	Found in flower during April.
Swertia alata.	Flowers here during August and September.
Swertia chirata.	The "Chiretta" of the bazaars is very common, it flowers during the rains and when it begins to wither is collected, tied up in bundles and sold. I have no doubt that other varieties of Swertia occur up here, but so far I have only met with the two noted.
Halenia elliptica.	Found on all hill sides in all shady localities. Flowers during the rains.

LII.—BORAGINACEÆ.

Cordia myxa.	Is common in the Dun and ascends up all the warm valleys into the higher hills. Flowers in March, fruit ripens about June. The viscid sweetish pulp is eaten and is used as gum for sticking paper, *ex : gr :* boys' kites. Vernacular name "Lassora."

Ehretia lævis.	Is also a very common Dun tree, ascending to about 4,000 feet. The branches are lopped for fodder. Vernacular "Chamror." Flowers about March.
Cynoglossum furcatum.	Common on all road sides and elsewhere. Flowers during the rains. Commonly called the "forget-me-not."

LIII.—CONVOLVULACEÆ.

Convolvulus arvensis.	Common, blooms throughout the rains.
Evolvulus alsinoides.	Common on the grass covered lower slopes and old abandoned fields. Appears to flower throughout the year.
Porana paniculata.	Found in all the warmer valleys, blooms about October when the plant looks very pretty covered with a profusion of snow-white scented flowers. The twigs of this climbing plant are used for making baskets in the Dun.
Cuscuta reflexa.	The Dodder, vernacular "Akas-bel" is a most troublesome parasite. It quickly spreads and generally kills the host it grows upon. It ascends from the plains into the hills to about 6,000 ft. I noticed some fine Duranta hedges in Dehra that were completely smothered by it and were, I do not doubt, finally destroyed. It is a favourite remedy with the natives who use it for poultices and fomentations in cases of swellings of the joints and Rheumatism.

LIV.—SOLANACEÆ.

Solanum verbascifolium.	Found on the cart road about 4,000 ft. and again above the Rajpur Road at 6,000 ft. appears at all times to be in flower and fruit. Vernacular "Ban-tamákhu."
Solanum indicum.	In waste places below Mussoorie; flowers and fruits throughout the year. All parts of this plant are medicinal. Vernacular "Bhat-kataiya."
Physalis minima.	Common on all waste places, in flower and fruit during the rains.
Physalis peruviana	The "Tippari" is a garden plant and is cultivated extensively for its yellow Gooseberry like fruit.

Nicandra physaloides.	Is a very common roadside plant and bears showy blue flowers during the rains and fruits in October.
Datura strumonium.	The thorn apple is common on all waste places chiefly near houses ; flowers during the rains. Variety "tatula" bearing purple flowers is also found.

LV.—SCROPHULARINEÆ.

Scrophularia himalensis.	Common ; flowers during the rains.
Mazus rugosus.	Common in shady damp spots, flowers throughout the rains, a pretty little plant bearing light blue flowers.
Torenia cordifolia.	Found in old fields below Mussoorie. In flower during the rains.
Leptorhabdos benthamiana.	Found on Gentian hill, in flower during September.
Pedicularis carnosa.	Is very common, growing in grass ; Flowers during September.

LVI.—GESNERACEÆ.

Chirita bifolia.	Is found in Mussoorie on rocks in shade, but it is very common on the Rájpur Road below Jherripáni. A pretty annual, bears long purple-blue Gloxinia like flowers.
Platystemma violoides.	This pretty little plant is very common here covering all large moss-grown rocks, bears during the rains dark-blue violet shaped flowers.

LVII.—ACANTHACEÆ.

Strobilanthes dalhousianus.	Is very common and flowers annually August to October.
Strobilanthes alatus.	So far I have found this in the old Botanical Gardens, in flower in September.
Justicia simplex.	A very common roadside weed on sunny or dry aspects.
Adhatoda vasica.	In all the warmer valleys up to 4,000 feet ; vernacular "Bansa" or "Pia-bansa." The leaves are considered medicinal. The wood is burnt into charcoal for gunpowder.

Dicliptera bupleuroides.	Very common roadside weed, flowers throughout summer and rains and well into winter.

LVIII.—VERBENACEÆ.

Verbena officinalis.	Found on Gentian Hill, not common. In flower during September.
Vitex negundo.	Common below 4,000 feet. In flower during the summer and rains. Vernacular "Samalu". The leaves are used in native medicine as a poultice and for fomentations in Rheumatism and swelled joints.

LIX.—LABIATÆ.

Plectranthus Ierardianus.	Common: in flower during September.
Plectranthus rugosus.	Common: in flower during September.
Elsholtzia polystachya.	Found in old Botanical Gardens. Flowers in September. Found in other parts of the station since.
Micromeria biflora.	A very common roadside plant growing on rocks and banks. Flowers from Summer well into Autumn.
Salvia lanata.	Very common in all rocky slopes and banks; flowers during the Summer.
Nepeta leucophylla.	Common on most stony dry waste places. Flowers throughout rains.
Nepeta graciliflora.	Found in flower in October.
Nepeta govaniana.	Common: flowers in September.
Cranitome versicolor.	Very common, growing on rocks and banks. Flowers during rains and well into Autumn.

LX.—PLANTAGINEÆ.

Plantago major.	Very common in Dehra Dun and probably occurs at Mussoorie but I have not met with it so far. Flowers there during Summer and rains. Canaries relish picking out the minute seeds from the spikes when offered them.

LXI.—NYCTAGINEÆ.

Boerhaavia repens.	Common on cart road on dry waste places Found in flower in April.

LXII.—AMARANTACEÆ.

Celosia argentea.	Common in fields below Mussoorie. Flowers in rains.

Cyathula tomentosa.	A very common, troublesome shrub. Flowers during the rains.
Ærua scandens.	Found above cart road, climbing on bushes. Flowers throughout the rains.
Achyranthes aspera.	Common everywhere. Vernacular "Chirchita". All parts of this plant—the seeds, leaves and roots—are used medicinally in native medicine. Flowers during the rains.
Achyranthes bidentata.	Is also common and flowers during the rains. Several varieties of the goose foot are found in and about Mussoorie.

LXIII.—CHENOPODIACEÆ.

Chenopodium album.	Is very common about all waste places. A tall growing variety with large leaves is extensively cultivated in the hills and ascends to very high elevations and is found growing in villages in the mid-Himalayas up to 9,000 feet and forms one of the staple foods of the hill people. Vernacular "Bathu" or "Bathwa": a rain weather crop.
Chenopodium opulifolium.	Is also a common Mussoorie plant.

LXIV.—POLYGONACEÆ.

Polygonium recumbens.	Is very common. Flowers during the rains.
Polygonum amplexicaule.	This really pretty plant is very common during the rains. Two varieties, one with white and a second with red flowers, occur here. The former is more common than the latter.
Polygonum aviculare.	Common : of very variable habit ; flowers throughout the rains and well into October.
Polygonum alatum.	Flowers September-October.
Fagopyrum cymosum.	Is very common and bears large panicles of white flowers from August to October. Two varieties of Buckwheat, one with slightly bitter seeds, Vernacular "Phapra" and the other sweet seeds "Phullen" are largely grown by the hill people of the mid-Himalayas and are cropped at very high elevation.

Rumex hastatus.	Is a very common weed. Flowers Summer and rains: bears very pretty pink whorls.
Rumex nepalensis.	Is the common Dock up here and grows plentifully. Flowers in Summer and rains.

LXV.—THEYMELÆACEÆ.

Daphne cannabina.	Vernacular "Satpura". Is plentiful in most shady localities. Bears large heads of white flowers throughout Summer and rains. From the inner bark a strong coarse paper is made.
Wikstroemia canescens.	Is a very common shrub up here. Flowers during September-October. Has a very strong bark from which good fibre could be obtained. Vernacular "Chamboi".

LXVI.—LORANTHACEÆ.

Loranthus longiflorus.	A very common pest in the Dun where it attacks most trees but chiefly the "tun" and "shisham". It ascends into the Mussoorie hills but is not common. Flowers in January and February. Vernacular "Bànda".
Viscum album.	The common Mistletoe is very common up here, found growing on Apricot, Walnut and Cherry trees. Flowers about April; ripens its berries during November and December.
Viscum japonicum.	This leafless parasite is found on *Quercus incana*, generally in flower about July.

LXVII.—EUPHORBIACEÆ.

Euphorbia nivulia.	Is very common, covering the dry rocky slopes of the hills above Rajpur. Flowers during the hot months. Vernacular "Thor".
Sarcococca pruniformis.	This small evergreen shrub is found in most shady localities. Flowers about April-May when it forms good material for vases and table decorations.
Andrachne cordifolia.	Is a common Mussoorie plant. Flowers about September.
Phyllanthus emblica.	Vernacular "Aonla." Found plentifully in the Dun and ascending into the warm valleys below Mussoorie to about 4,000 feet. Flowers during the hot months: fruit ripens late in winter. The fruit is made into

	preserve. The leaves and bark are used for tanning leather.
Phyllanthus parvifolius.	Is a common roadside plant, it flowers during September, fruit ripens end of October.
Putranjiva roxburghii.	Is found in the Dun and lower valleys about Mussoorie. Flowers during the hot months, ripening its fruits during the ensuing cold weather. The nuts are strung into rosaries and tied round the necks of delicate children to ward off disease. Hence its vernacular name " Jia-pota " or " Jia-putra."
Bridelia retusa.	Is also a common Dun tree. Flowers during the rains, fruit ripens cold weather. Vernacular " Gondni " or " Goli."
Jatropha curcas.	A very common hedge plant in the Dun ascending to the foot of the hills, quite common at Rajpur. Vernacular " Wilaiti Arand " or "Sufed Arand." Appears in flower and fruit throughout the year. The seeds are medicinal.
Trewia nudiflora.	Common on banks of streams in the Dun and up the Jumna valley. Flowers during the hot months, fruits during cold weather.
Sapium sebiferum.	Vernacular " Tar charbi," a small crooked gnarled tree. So far as my memory serves me this was introduced to the Dehra Dun but is now found as an escape all over the Dun, it resembles the Shisham in general appearance. Flowers during rains, fruit ripens in cold weather.
Mallotus philippinensis.	Vernacular " Rohni," is a very common tree in the Dun and ascends up all the warm valleys below Mussoorie to above the cart road—4,500 feet, flowers during the warm weather and fruits during cold weather when the tree becomes conspicuous being laden with bunches of globose capsules which are densely covered with a bright red powder: vernacular " Kamela." In Kamaon the berries are collected in coarse blankets " Kammal " through which the powder is sieved, whence probably its native name. The powder is used extensively for dyeing silks and in medicine as a vermifuge. I have found it one of the safest remedies for worms in

dogs and other animals. The seeds are often used to adulterate "bai-berang" which are the seeds of *Embelia ribes.* I noticed in Chamba the hill people chewing the leaves of "Rohni" in place of "Pan." It possesses an agreeable aromatic taste.

LXVIII.—URTICACEÆ.

Celtis australis.

Vernacular "Kharik," is common throughout the Dun and ascends here to over 5,000 feet, generally about village areas. The wood is yellowish and is tough and elastic. The leaves are lopped for fodder. Flowers during the warm weather, fruits in rains.

Trema politoria.

Vernacular "Khagsa," fairly common on the lower warmer slopes generally on waste lands; the leaves are rough and are used as sand paper in polishing horn, the bark is strong and yields a good fibre. Flowers during the hot months, fruits in the rains.

Cannabis sativa.

The Indian hemp, vernacular "Bhang," is a common weed up here, wherever a field is left fallow for a season the "bhang" grows up thickly to the exclusion of all other vegetation. Farther in the interior it is grown as a field crop chiefly for its fine, excellent fibre which the paharis spin and weave into a coarse canvas, also used for nets and fishing lines. The seeds form an article of food, are roasted or parched and eaten, apparently with great relish, mixed with equal proportions of Amaranth seeds similarly treated. Besides the above uses this useful plant yields three distinct drugs.

The flowering tops of the female plant which are fully charged with gum are dried and sold under the name of "Ganga." The gum "Charras" is extracted by rubbing the plant briskly between the palms to which the gum readily adheres and is scraped off and collected for the market. The dried coarser leaves are sold under the name "Bhang."

It is perhaps curious that while the English word canvas is derived from cannabis the pahari name "Bhangela" has for its origin "Bhang." The seeds produced under cultivation are much larger and contain more oil than of plants that grow up spontaneously.

Morus alba.	Cultivated, flowers and fruits during the summer months. Is planted in avenues along roads in the Dun, the leaves furnish food for silk worms; fruit eaten.
Morus serrata.	Planted and wild at Mussoorie, very common, both species are commonly known in vernacular as "Tut" or "Tunt." Flowers and fruits during summer. The wood of both these trees is tough and elastic, cleans well and takes a beautiful polish, is put to a variety of uses but more especially for racket and tennis bats. It is generally of a yellow-brown colour often mottled with dark markings.
Morus indica.	Very common in Dehra Dun. Vernacular "Sia tut" or "tutri," a quick growing tree and yields a pretty mottled brown colour wood. Flowers and fruits like the preceding.
Broussonetia papyrifera.	The paper-mulberry. Was introduced into Dehra Dun but is now found as an escape and is fast self sowing and spreading itself over the Dun. The wood is soft and useless but the bark forms a good material for paper.
Ficus gibbosa (parasitica).	Is commonly met within the Dun growing as an Epiphyte on other trees. Vernacular "Chanchri" or "Kharsari." Fruits in cold season.
Ficus bengalensis.	Vernacular "Bar," is met with in the Dun planted near villages and on road sides as far up as Rajpur. The wood of the tree is moderately hard, stands well under water and is on this account used for well curbs "nim-chaks." The ærial root drops are tough and elastic, make good tent poles but unless well preserved are subject to be attacked by Borers. The branches are lopped for elephant fodder. The juicy milk is made into bird-lime, the fruit is eaten by natives and is greedily devoured by monkeys and all fruit-eating birds.
Ficus elastica.	Is found under cultivation in gardens at Dehra. I have not heard that any attempt has ever been made to extract and prepare India-Rubber from it.
Ficus religiosa.	The well known "pipal," common in the Dun ascending to over 4,000 feet. Often found planted in

	the villages in the hills near temples. The branches are lopped, the larger for elephants, the lesser for camels, goats and cattle. New leaves appear in March, fruit ripens in May. Is sweetish and is eaten.
Ficus clavata.	Vernacular "Kania," common, fruits during June.
Ficus cunia.	Vernacular "Kheina" or "Jarphal." Common in the Dun and ascending up along water courses and streams well into the hills. Easily recognised by its long drooping panicled racemes often several feet long issuing from the base of the trunk and larger branches.
Ficus scandens.	Common in the Dun in all moist localities and ascending into the hills along all perennial streams. Fruit during the rains.
Ficus foveolata.	Common, creeping on damp rocks and on trees completely covering their trunks, clinging to the bark by roots at the joints. A very variable plant. Fruit ripens in the rains.
Ficus palmata.	Common along banks of streams. Vernacular "pheru" or "anjir," fruit ripens about July or October.
Ficus glomerata.	Vernacular "gular," is a common Dun tree but does not ascend much further than the foot of the Mussoorie hills. It is a moisture loving tree. The fruit when quite young is eaten cooked as a vegetable and is eaten uncooked when ripe from March to July. In the Central Provinces the "Gonds" collect and dry large quantities and stock it for food and eat it mixed and boiled with rice. There it is known as "Dumar."
Ficus roxburghii.	Fruit ripens during summer, is often collected and sold in the bazaars.
Urtica parviflora.	A very common nettle up here. Vernacular "Bichchhu." Flowers throughout hot weather and rains.
Girardinia heterophylla.	Common, the tender parts are cooked and eaten as a vegetable. The stems yield a good fibre. Flowers during the rains.
Pilea umbrosa.	Very common in shady localities. Flowers in September.

Pilea scripta.	Very common in shady localities. Flowers in September.
Lecanthus wightii.	Common everywhere, growing on rocks and banks, Flowers during September.
Lecanthus wallichii.	Is abundant on north aspects in damp shady places. Flowers during September.
Boehmeria rugulosa.	Vernacular "genthi." This tree was very plentiful about Mussoorie. Owing, however, to the wood being extensively used for "thekis," bowls, cups, &c., for which articles there is always a ready sale at Mussoorie, it has now almost disappeared. It flowers during the rains, fruits in cold season.
Boehmeria macrophyla.	Vernacular "Bara-siaru," plentiful above Rajpur. it yields a strong fibre : flowers during the rains, fruit in cold weather.
Boehmeria platyphylla.	Vernacular "Khagsha," found at Mussoorie, in flower in August, fruit in October. The branches are lopped and stored for fodder.
Debregeasia velutina.	Is very common. Vernacular "Tushiari" or "siaru," yields a good fibre for ropes, the fruit is eaten. Flowers in July, fruit ripens in cold weather.
Debregeasia hypoleuca.	Is also very common, vernacular "siaru," yields a good fibre and the fruit is eaten. flowers about April. fruit ripens July-August.

LXIX.—JUGLANDEÆ.

Juglans regia.	Vernacular "Khrot" or "Akhrot," is both wild and planted, the wood of the common walnut is greyish-brown with darker streaks, often very prettily mottled, it polishes well and is used for gun stocks chiefly. It flowers here about March, fruit ripens September.
Engelhardtia colebrookiana.	Not very common but occurs here, flowers in March, fruit in August. Vernacular "Mowa."
Myrica Nagi.	Vernacular "Kaiphal," grows about Mussoorie, the bark is used in native medicine and for poisoning fish. The fruit is brought in by the paharis during May and June and finds a ready sale.

LXX.—CUPULIFERÆ.	
Corylus colurna.	The Himalayan Hazel, vernacular "bhotia badam" is a rare tree up here. I have met with two only on the north slope of the hill in dense forest, the wood is pink and is moderately hard. The nuts ripen in August when they are collected and brought for sale.
Quercus incana.	Is the only oak found here, it flowers in April, fruit ripens in October but remains long on the tree, the wood is excessively hard and difficult to work, it makes good fuel and charcoal.
LXXI.—SALICINEÆ.	
Salix elegans.	Is fairly common in streams. Vernacular "Kadwi ;" branches are lopped for fodder, flowers March, fruit in June.
Salix tetrasperma.	Vernacular "Bhains" or "Gad Bhains," common in streams in the Dun and ascending to Mussoorie, the pliant twigs are made into baskets. Flowers in April.
Salix babylonica.	The Weeping Willow is cultivated. Flowers during the hot season.
Salix alba.	Also occurs. Flowers during April.
Populus ciliata.	Not common, seen a few trees which seem to be cultivated. Flowers March-April. Fruits in June.
LXXII.—CONIFERÆ.	
Pinus longifolia.	Is a common pine up here and ranges from 2,000 feet to 7,000 feet. Vernacular "Chir," wood used extensively for beams and planks, Crude turpentine, vernacular "ganda-bi-roza," the gum obtained from this tree from which is distilled turpentine ; flowers about March, the cones remain long on the tree. The needles are used as bedding for horses and cattle and afterwards furnish a good stimulant manure.
Cedrus deodara.	Very little deodar is to be met with at Mussoorie now. The only trees to be seen are those preserved on private estates. The cones form in April and seed is shed in October.
LXXIII.—ORCHIDEÆ.	Of the Epiphytal Orchids very few occur here.
Aerides affine Syn. multiflorum.	Is very common in Dehra and is found on the Rajpur Road up to 4,000 feet. Flowers in June.

Aerides odoratum.	This is also plentiful in the Dun and is associated with *A. affine.* Blooms in June and July. I have both in cultivation up here.
Rhynchostylis guttata.	Is also common, growing on trees in the Dun but I have not come across it much higher than Rajpur, blooms during May-June.
Sarcanthus filiformis.	Common throughout the Dun, bears insignificant yellow flowers streaked with red lines, flowers about August.
Vanda parviflora.	Also occurs, blooms during September.
Dendrobium Sp.	Not yet identified, found growing on road to Rajpur at 4,000 feet.
Phajus albus or as it is now called *Thunia alba.*	This pretty Orchid was once very plentiful on the hills about Mussoorie, but has now all but disappeared owing to the greed of pahári hawkers who found a ready sale for clumps of it in bloom to visitors up here. This abuse grew so great some years ago that Mr. Gamble, the then Director of the Forest School at Dehra, prohibited the collection of it from the Forests under his charge.
Cœlogyne cristata.	Is met with up here, growing on rocks in shade; flowers in summer.
Anœctochilus roxburghii ?	Plants found in a shady ravine at Landaur. I am not quite sure that I have identified the plant rightly.
Microstylis walichii.	Very common every where at Mussoorie, flowers in July and August.
Herminium angustifolium.	Grows plentifully, blooms in August.
Habenaria intermedia.	Is a very common Orchid up here, it is the first of the ground orchids that comes into bloom, flowers early in July.
Satyrium nepalense.	Plentiful in grass, blooms during August and September. I have no doubt that Mussoorie furnishes many more kinds which owing to want of time and opportunity have escaped notice.

LXXIV.-SCITAMINEÆ.

Roscoea procera.	Is perhaps the commonest of the wild flowering plants, the hill sides look very pretty dotted about with its lilac flowers during the rains.

Cautlcoea spicata.	Fairly common, flowers during the rains.
LXXV. HÆMODORACEAE.	
Ophiopogon intermedius.	Known here as the lilly of the valley, is very common, blooms in June.
Aletyris nepalensis.	Common, growing on trees and rocks, flowers during rains.
LXXVI.—HYPOXIDEÆ.	
Hypoxis aurea.	Growing on road sides, in flower during July.
LXXVII.—DIOSCOREACEÆ.	
Dioscorea kumaonensis.	In valleys below Mussoorie, often cultivated for its tubers which after preparation are eaten by the natives.
Dioscorea sativa. *Dioscorea deltoidea.*	In valleys below 5,000 feet, generally. Cultivated by villagers. In Chamba the tubers are used to wash blankets, flower during the rains.
LXXVIII.—LILIACEÆ.	
Smilax parviflora	Is common, as also two other varieties not yet identified.
Asparagus adscendens, and *Asparagus racemosus.*	Both are found though nowhere plentiful, the former flowers in November, the latter in the rains.
Allium rubellum.	Common, growing on grassy slopes, flowers during the rains.
Lilium giganteum.	Is not found in the immediate vicinity of Mussoorie but plants in flower are often brought in and offered for sale by the pahâris from the interior.
Lilium polyphyllum.	Found in woods on the north slopes, flowers during rains.
Lilium wallichianum.	Found further in the interior, flowers during the rains.
Lilium thomsonianum.	Is common, in flower during April, when bundles of this pretty plants may be seen being hawked about the Station for sale.
Gloriosa superba.	Common in the Dun, but I have not found it at Mussoorie, flowers in August and September.

LXXIX.—COMMELINACEÆ.

Commelina polyspatha.	Fairly common, blooms in September-October.
Commelina obliqua.	Very common, flowers during August-September.
Cyanotis barbata.	Found in flower in September.

LXXX.—JUNCACEÆ.

Juncus concinnus.	Fairly common, blooms in August.

LXXXI.-ARACEÆ.

Arisæma jacquemontii	Common, flowers during the rains.
Remusatia hookeriana.	Very common, growing on trees, rocks and banks. I have specimens in cultivation in hanging baskets. In September it throws out its bulbule bearing shoots which look curious and pretty.
Acorus calamus.	Vernacular "Bach" or "Ghor-bach", in streams in the valleys below Mussoorie, grows freely in the water logged ground at Nàla-Pàni near Dehra, both rhizomes and leaves of this aromatic plant are used medicinally. The powdered rhizomes or a decoction made by boiling the roots in water forms a good wash for dogs and poultry to free them of insect pests.

THE PRESERVATION OF NATURAL HISTORY SPECIMENS IN AIRTIGHT CASES.

BY

JOHN WALLACE, C. E.

The Preservation of Natural History Specimens, especially in the Tropics, involves very often far more trouble than does their capture, for air, sunlight, dust, fungoid growths and various insects are arrayed constantly against the collection. Moist air softens them and assists fungoid growths, dry air shrivels and distorts them, sunlight causes their colours to fade, dust by requiring cleansing involves wear that is ultimately destructive, and insects effect the most rapid destruction of all by eating them. A cool, dry, atmosphere, uniform in temperature and humidity, and suitably protected against the invasion of fungi and insects, offers ideal conditions for the dry preservation of specimens, while immersion in some preservative liquid within an airtight glass vessel has been the favourite means employed for creatures whose natural appearance it is desired to preserve without stuffing. My remarks will be confined to the first category which demands the protection of airtight boxes or cases. In Bombay the temperature of the air ranges from 53·3 to 100·2 degrees Fahrenheit and varies from that cause alone by about 8½ per cent. of its original volume. The moisture ranges from 34 per cent. of relative humidity to 98 per cent. and to actual saturation on the rare occasions of a fog, that is to say, from 1·51 grains of water vapour per cubic foot at 34 per cent. to 11·79 grains at 98 per cent.

The normal pressure of the air on the objects about us is 14·7 lbs. per square inch or 2,116 lbs. per square foot, a force that would crush many hollow objects were it not balanced by a similar interior pressure. The pressure of the atmosphere varies very slightly in Bombay, the range being 5·89 tenths of an inch of mercury with corresponding changes of volume.

When the barometer falls 0·589 inch at, say, 80 degrees Fahrenheit, the pressure in pounds per square inch of the air will fall from 14·7 to 14·41 and the pressure on the exterior surface of a completely airtight case would be reduced by 41·76 pounds per square foot. A perfectly tight and empty kerosene tin would, in such a circumstance swell visibly and, were it perfectly elastic, it would increase in volume by 2·04 per cent. On the return of normal pressure it would resume its original size and shape.

A change in temperature has a similar effect on the volume of the air. A rise from 50 degrees to 100 degrees Fahrenheit would, in a rigid closed vessel, cause an increase of pressure equal to 1·24 lbs. per square inch or 178 lbs. per square foot. The increase in volume, if expansion were allowed, would be 9·1 per cent.

Such a tin is on the table along with a delicate anemometer gauge which will measure pressures from 12 inches of water down to $\frac{1}{2000}$ of an inch. When the tin and the gauge are coupled by means of a rubber tube the smallest pressure on the tin causes a responsive movement on the gauge. A pressure of 0·589 inch of mercury is equal to about 8 inches of water. This pressure applied to the tin may be heard as well as seen. The effect of change of temperature of the air within is made visible by laying a piece of cloth dipped in hot water upon the case.

An immediate movement is visible on the gauge. These changes usually take place slowly enough to modify their effect on closed cases, owing to leakage, and thus, with every change of temperature or of pressure there is a movement of air in or out of boxes and show cases.

There is one wave of heat per twenty-four hours having its maximum at 2-30 P. M. and its minimum at average sunrise. In the same period there are two waves of barometric pressure both tending to affect the volume of air surrounding a closed vessel, and these influences sometimes work together and sometimes in opposite directions. If there is any communication at all between the air in the case and that outside it, a breathing action takes place. tending to mix and assimilate the two atmospheres.

If the outer air be damp and the contents of the vessel are dry, the air with each inflow will leave a little of its moisture on or in the contents, until they will absorb no more, and if the air be drier than the contents, moisture will be carried away as far as the absorbing capacity of the air will allow. A varying humidity would have a corresponding effect. With dust, the effect is not quite the same. The speed of current entering a small hole in a box is quickly dissipated, and the dust it carries is dropped, but as the air only regains its velocity again at the outlet it cannot gather up the dust, which thus accumulates. We are now in a position to understand how articles that have been placed clean and dry in a box or drawer may become damp, dusty and mouldy, and our business is to find out how to prevent these unpleasant manifestations.

It is by no means easy to make a box or cupboard (unless it is very small) that is free from the risk of air leakage. Although wood does not alter appreciably in length, it is constantly changing in width with the seasons. influenced mainly by the amount of moisture in the air.

Moisture will traverse a box of one inch teak during the monsoon, even if sheltered in a house from the rain. This may be prevented to a considerable degree by varnishing, but comparative security against damp can only be gained by means of a metal lining and a very well fitted door or lid. The box then becomes a frame strong enough to give adequate support to the lining, and thick enough at the edges to form a good joint with the lid. A well made deal packing case may be made reasonably airtight at little cost. The lid is nailed on, and the box put in a good repair ; the lid is then sawn off with about three inches of the box attached. Next, the mouth of the box is carefully levelled with plane and straight edge all round, after which the lid is fitted to it, the edge of the box being rubbed with chalk to indicate points of contact. The two surfaces must touch all round. Linings of tinplate or zinc are put into the box and the lid, and fixed with small nails to the inner sides without touching the joint faces. To attach the hinges the lid is put in place with a heavy weight on it, and the hinges are attached with screws from the outside A couple of hooks on the opposite side keep the lid in contact with the box. A careful workman can fit a lid of this kind sufficiently well to exclude all dust, and diminish air leakage to a satisfactory extent. A small amount of quicklime or other absorbent will preserve the contents of such a box for a long period. In places where the white ant is troublesome a coating of spindle (mineral) oil will give to wood such a bitter taste that no vermin will touch it. This oil sinks in, but does not evaporate like kerosene. For cabinets and show cases the process of Mr. Powell gives absolute security against attacks by vermin. Examples of wood treated by this process are on the table, along with a kerosene tin which fulfils all the duties of a large drying bottle at a fraction of the cost. It is fitted like a coffee canister but its peculiarity is a cap which fits tight without sticking. The neck, standing up about 1½ inches, is tapered, while the cap is parallel and four inches deep. When pressed over the neck, the lid being elastic fits closely all round with only a line of contact so that it cannot stick. A bag of quicklime hangs within the lid to absorb moisture. Cartridges have been kept ten years in such a box and used without a failure. The neck and cap may be made 7 inches in diameter, admitting large articles. Lime should, when possible, be put in the highest part of a dry box or case, as water vapour, being only three-fifths of the weight of dry air, always rises. The lime thus establishes a circulation of air until all the water vapour is absorbed or the lime becomes saturated.

This tin although superior to many boxes is not so tight as it appears for, when tested with the pressure gauge a pressure of three inches of water disappears in a few seconds. It has nevertheless done excellent service.

The following absorbents are used for drying the air in closed vessels. Oatmeal, dried at 350 degrees F. chloride of calcium, quicklime, dried sawdust, chloride of sodium or common salt, and sulphuric acid. Most of these may be de-hydrated and used again. When any object or specimen is placed, damp, in a box the lime or other absorbent may have to be changed one or more times to bring the object to the required condition, after which the duty of the absorbent will be to compensate the influx of moisture due to changes of temperature or atmospheric pressure.

The dampness of the air in any case or box may be observed with the aid of a Sassure hygrometer which indicates moisture by the alteration of length of a single hair that has been washed in pure alcohol to free it from grease. If the case is large a small wet and dry bulb hygrometer may be used. A certain but unknown amount of moisture may be tolerated in cases containing natural history specimens, the amount depending on the temperature of the air. Absorbents are of very little use in an ordinary cupboard or almirah during wet weather. The joints of the doors and framing offer an easy passage for moisture, and closed bookcases for the same reason offer a very doubtful protection to books. Certain bindings are very absorbent, and become readily mildewed. Mr. E. H. Aitken, a keen observer of these things, kept his books in an open case in the middle of a room. To arrest the attacks of insects he coated his cloth-bound covers with a thin solution of copal varnish in turpentine, which maintained the new appearance of the cloth and arrested deterioration. Very valuable books can only be preserved in India in the special boxes just described. Of insecticides there seem to be a liberal provision whose properties are fairly well known. Petrol in a piece of sponge produces a deadly but inflammable atmosphere. Naphthalin is largely used, but it discolours brass, copper and the precious metals ; dissolved in petrol it may be applied with success with a fine dropping tube to worm holes in books. Camphor is less effective than naphthalin. Mineral oil is fatal to all parasitic insects but not to all fungoid growths.

In conclusion, I would add a few remarks on the joints of boxes or cases. Two surfaces, however narrow, in close contact produce an airtight joint. There is therefore no advantage to be gained by ribs or recesses which complicate the manufacture of uniform and other cases. Fine felt on a joint may filter the air but it is not airtight and will not arrest moisture. Cork is only airtight under considerable pressure, and to get a level bearing all round a box would involve much work on the cork. A true metal and metal joint can only be produced with the aid of machines. A line of India-rubber cord cemented to one surface of a joint will become really airtight with very little pressure, but it has an unfortunate way of sticking to both surfaces, and an application of graphite is only a partial remedy. The merits of any vessel, for which airtightness is claimed, may be easily tested by means of a cycle air pump and a small length of tube attached to the bottom of the vessel. A smoking cigarette passed round the joints will at once detect any leakage by the effect of the escaping air on the smoke.

This subject might be extented to the volume of the book, for it touches many important matters in daily life and commerce. It offers an explanation for the deterioration of large quantities of merchandise in India ; it makes clear the cause of accumulation of dust in a closed empty building which may remain clean outside, and it suggests methods of storage and preservation of goods in the Tropics which will, some day, effect important economies.

THE PRESERVATION OF PINNED INSECTS IN THE TROPICS.

Mr. H. Maxwell Lefroy gave me the following information :—

The insect collections at Pusa are stored in over 2,000 store boxes ; they have been gradually built up during the past five years under extremely unfavourable conditions as regards housing, transfer from place to place, supervision and so on, but are now permanently housed in the Pusa Laboratory. Below we give our experience of keeping collections of pinned insects under the conditions obtaining in India.

In the first place storage in permanent drawer cabinets has not been possible, because for one reason we would not be able to space out the drawers in these cabinets beforehand to meet expansion since the Indian fauna is so little known that we could not leave gaps for probable additions. We have, therefore, exclusively used store boxes, since they can be moved about and expanded without requiring much moving of individual pinned specimens.

Owing to the climatic conditions, well-made English store boxes are impossible, the deal boxes warp, card-board boxes become ungummed. The climate in the plains embraces the two extremes of dry heat and moist heat, it is difficult to realise this unless it is experienced. In April-May, we get scorching winds, extremely dry with a temperature (in the shade) exceeding 110° F. These are so dry and hot that all wood shrinks and cracks, deal especially. Following this the humidity becomes intense, still with a temperature up to and over 100° F., till with the rains a very high humidity sets in and persists. Still muggy air, intense moisture and heat (a minimum in the laboratory of 85° a maximum of 95° with a steady humidity of between 85 per cent. and 90 per cent.), induces the opposite of the dry heat ; all wood swells again. No collection can be protected from the humidity unless in steel safes with Calcium chloride to dry the air, and this entails the locking up of the collection during the busy season, an impossibility if any useful work is to be done. One has therefore to contend against extremes of dryness and moisture, with the latter come moulds, lice (psocids), and beetles, and since *all* boxes warp, the entry of these to the collection is inevitable. Moulds will grow on anything during the still hot moist months, books, boots, curtains, paper, wool, doors, leather, almost everything except metal grows moulds ; psocids of course abound and only constant fumigation of every room with hydrocyanic acid could check them. Beetles are not so serious a danger.

With regard to boxes, we use teak boxes 17 inches by 11 inches, all are of one size and are stored horizontally in racks. Cartons are useless as they cannot be guaranteed against mould without a free use of corrosive sublimate solution, which is good for neither the pins nor the health of the worker. Our boxes were lined with cork or cork sheeting, papered inside and varnished outside. Creosote, napthalin, benzene, carbolic acid, camphor, chloroform, carbon bisulphide, have been used in the boxes, either in small vessels, or in a cell, or mixed together and poured into the box, the final mixture adopted was a saturated solution of napthalin in benzene containing 30 per cent. of white beechwood creosote, poured into each box before use and at intervals, it keeps out psocids, keeps down moulds, the theory is that the benzene clears the box of everything at once, the naphthalin keeps out psocids and beetles, the creosote checks moulds. When you have 2,500 boxes tightly packed in one room and you put into each box half an ounce of benzene, etc., you run risk of explosions and of injuring the health of any one who works there. We have therefore tried to find a substitute.

A further difficulty is that paper in a damp climate, goes yellow and eventually brown; that means an unsightly box or the removal of all the specimens to a fresh box. We tried boxes containing no cork but paper stretched tightly round one fixed and one adjustable bar but we abandoned these. If one could get a permanently white surface, without paper, it would be a boon.

We will not describe the various devices we have tried but will go straight to the final product; every possible device that suggested itself was tried culminating in the following:—

An ordinary teak store box is used, without cork in, well varnished inside top and bottom; a sheet of cork matting slightly smaller than the bottom, is cut ready, painted white on one side and dried; a mixture of hard paraffin, 80 per cent. (melting point 55-60°C) and napthalin 20 per cent. is melted, the paraffin first; it is poured into the box and the cork sheet put down and carefully smoothed out, so as to get the hot liquid over the cork sheet, and so as to leave no air below the cork, this sets hard very soon and before or as it does so, more melted paraffin—naphthalin is poured over and allowed to set in a smooth even sheet. To whiten this layer completely the cork sheet is first painted white and allowed to dry. This gives an even dead-white surface, which may be kept smooth by the application of a warm roller or smooth metal surface; a solid sheet of this paraffin is not good for pins as it has no elasticity; but by embedding the cork in it, the elasticity of the usual box is retained, with the advantages of a hard napthalined surface which offers no harbourage to psocids or beetles. In addition, the sheet of solid paraffin goes far to prevent warping and to make the box air tight. No paper is used in the box at all; there is a well varnished lid, air tight and offering no harbourage to insects, the smooth sheet of paraffin is impervious to insects and fills in all the crevices, and the only harbourage for Psocids is where the lid falls on to the box.

The actual weight of one of our boxes with cork and without paraffin is 2,050 grammes; the paraffin added weighs between 350 and 400 grammes. This excessive weight is the one drawback; it is practically unavoidable if a stout teak box is used at all, the paraffin only increasing it by 20 per cent.

The addition of creosote to the paraffin has been tried and abandoned since it produces a less white surface.

Psocids, on dried insects from an infested cork box, put into one of these paraffin boxes die within 24 hours and may be found on the floor of the box; it is actually unnecessary to poison such a box in any way at all and we use no cells or napthalin. Our boxes have not been in use long enough for us to be able to definitely recommend them for adoption; the cold here is at present considerable, a minimum of 43° F. outside and 60° F. in the laboratory, but the paraffin is not too hard. We have not yet tested the boxes in a temperature over 105° F. and it is possible that when the temperature rises over 110° F., the specimens may develop grease or some other untoward thing happen. So far as our present experience goes, the boxes are admirable, no preservative need be used, no paper is there to turn brown, the smooth white surface shows up the insects splendidly and takes pins very well. It is possible that in time the naphthalin will evaporate enough to spoil the surface or that dust will accumulate on the paraffin. The relief of knowing that one's specimens are absolutely secure against psocids, moulds and beetles, without constant renewal of naphthalin is an enormous boon and we would recommend that the box be given a trial. We have over 120 in use in the reference collection, a large number more in daily use and at a later date will give the Society the results of our further experience.

Pins.—In our damp climate, a source of frequent damage to collections is the corrosion of the pins, often with the formation of masses of green matter. Steel pins rust, all pins we have used are liable to corrode and we have found no pin that is immune to corrosion. This is due partly to the tin coating of the tins, partly to the fact of an alloy being used. With a pure metal, uncoated with another metal, electrical action does not stimulate chemical action. We approached a prominent firm of pin-makers, with the results that pure nickel pins in a long thick size (No. 16) and a fine size (No. III) are now available at little more than the prices of ordinary black pins and at far less than pure silver pins. We would call the attention of workers in the tropics to these pins; they have not the elasticity of steel but they have a sufficient strength to stand ordinary wear and tear and, using pith for small insects, a long thick pin and a fine small one meet nearly all demands. We are inducing the makers to produce a double pointed fine pin, which can be pushed into a small insect from below and then (the other end) pushed into pith, this greatly facilitating the pinning of small insects. Such nickel pins, tested against all other pins, have entirely resisted corrosion where the latter corroded. On the continent, pure nickel pins are in use and can be purchased in continental sizes. So far as our experience goes nickel pins are advisable, but we have not had them under trial for a sufficiently long period.

It will be seen that we have not worked on the principle of making air-tight boxes for the very obvious reason that to use them you must (*a*) close the boxes when the air is dry and not re-open it till the monsoon is over, or (*b*) dry the air inside. The former is impossible, we cannot shut our collection from May to November. The latter is impossible in practice. We have tried calcium chloride and copper sulphate (calcined) in the boxes and abandoned it; it requires constant renewal if the boxes are opened at all, the calcium chloride becomes liquid, spills in the box and that box must be cleared out and remade as only soaking will take out the chloride. The subject is one of immense importance in this country, it would be an immense loss if collections like those of the late M. de Niceville were to perish, and if large reference collections cannot be maintained it must always be difficult to work. Some improvements are undoubtedly required, and we are still so apprehensive of damage that we never retain types of new species in this country; if new methods can be introduced it will be a great boon, and we would all welcome the suggestion and trial of new methods.

The use of stamped metal boxes has been recommended and, if the demand was assured, would be available; but one cannot afford to go in for so expensive a thing without an assured guarantee of success since the original cost of dies, etc., is very large. We propose to try these at a later date since the consumption of boxes at the Pusa Institute is very large, but we would prefer to wait until the paraffin boxes and nickel pins have been well tested, and we hope also to have the benefit of the experience and suggestions of members of this society.

NEW AND LITTLE KNOWN INDIAN HYMENOPTERA.

BY

LIEUT.-COLONEL C. G. NURSE.

The following paper deals with the Fossorial genera *Astata*, *Tachytes*, *Tachysphex*, and *Larra*, which form a portion of the Sphegidæ. All these are numerous in sandy localities, and I had good opportunities for studying them at Deesa, where the soil is specially suited to their habits.

Astata argenteofacialis.—(Cam. Mem. Manch L. Ph. Soc. (4) ii, 1889, p. 151).

This species, described from specimens from Barrackpore, was omitted by Bingham in Vol. I of Hymenoptera.

Astata quettæ.—(Nurse, J. Bo. Nat. Hist. Soc. ,Vol. XIV., p. 92).

When I described this species, I considered some males I had, though much larger than the ♀ described, to belong to the same species. On re-examination, however, I feel sure they belong to another species, and they are described below as *A. resoluta*.

Astata resoluta, n. sp.

♂. Clypeus and front with shallow punctures, the portion of the front about the ocelli shining, almost impunctate ; mesonotum finely and closely punctured at the base and at the sides, less closely on the disc ; base of scutellum shining, impunctate, remainder of the segment closely punctured ; median segment long, longitudinally striate and reticulate, its apex rounded ; abdomen minutely aciculate. Anterior ocellus nearly twice the size of the others, no furrow on front ; abdomen short, about $\frac{2}{3}$ the length of thorax and median segment, apex of basal segment constricted, apices of the others depressed. Black, covered with moderately dense white pubescence ; mandibles, except their tips, apex of scape of antennæ, apices of abdominal segments (frequently the greater part of the abdomen), femora at apex, and the whole of the tibiæ and tarsi red. Wings clear hyaline, nervures dark brown, tegulæ testaceous ; 2nd cubital cell at top $\frac{1}{3}$ the length of 3rd, and less than half the space bounded by the recurrent nervures, which divide the 2nd cubital cell into three subequal parts on the cubital nervure.

Hab.—Quetta ; not uncommon.

Length—7 mm.

Astata compta, n. sp.

♀. Clypeus and front moderately closely punctured, the portions near —the anterior ocellus and the margins of the eyes shining, with scattered punctures, mesonotum, scutellum, and postscutellum closely punctured, except on the disc of the two former, which are shining and more or less impunctate ; median segment rather short, strongly longitudinally striate and reticulate, roundly truncate at apex, the apical portion finely rugose ; abdomen smooth, shining. Antennæ pilose, the anterior ocellus scarcely larger than the others, the portion of the front below it without a furrow ; abdomen nearly as long as the thorax and median segment, the segments very slightly depressed at apex ·

legs strongly spined. Black; the mandibles more or less red; pubescence grey, moderately dense; wings hyaline, forewing with a slight flavous tinge, and a very slight infuscescence about the radial cell; nervures bright testaceous, tegulæ dark testaceous.

Hab.—Mt. Abu.

Length—8 mm.

Astata selecta, n. sp.

♀. Head minutely but shallowly punctured, the space below anterior ocellus and the vertex almost impunctate; mesonotum, scutellum, except at base, and postscutellum closely and finely punctured, median segment longitudinally striate and reticulate, abdomen smooth. Front without a furrow, median segment rounded posteriorly, with a slight transverse carina at the apex of the striation; abdomen with the apices of the segments slightly depressed. Black: the mandibles in the centre, the first two or three abdominal segments, and the femora, tibiæ, and tarsi red: apical abdominal segments bronzy testaceous; pubescence whitish, not very dense; wings hyaline, the apex beyond the radial cell infuscated: nervures, stigma, and tegulæ brownish testaceous, the recurrent nervures divide the 2nd cubital cell into three equal parts

Hab.—Deesa; January and September.

Length—5½-6 mm.

Astata interstitialis (Cam.).

The type specimen is a ♂, not a ♀. I cannot see any transverse striation on the median segment, which I consider finely rugose with a few short longitudinal striæ at extreme base.

Astata absoluta, n. sp.

♂. Clypeus and front closely and finely punctured, the space below the anterior ocellus shining; mesonotum, scutellum, except on disc, and postscutellum very closely punctured; disc of scutellum shining, almost impunctate, median segment rather short, strongly longitudinally striate and reticulate, its apex roundly truncate, the truncated portion finely rugose, abdomen minutely aciculate. Antennæ conspicuously pilose, anterior ocellus twice the size of the others, with a furrow running from it to the base of antennæ; abdomen short, the apex of the first segment constricted, the apices of the remainder depressed. Black; the pubescence greyish, moderately long; the apices of the abdominal segments narrowly golden testaceous; wings hyaline, nervures bright testaceous, tegulæ black; radial cell rather long, 2nd cubital cell at top ⅓ the length of 3rd, ⅔ and the length of space bounded by the recurrent nervures, which are received into the 2nd cubital cell before and after the middle respectively.

Hab.—Mt. Abu.

Length—11 mm.

Astata kashmirensis, n. sp.

♂. Clypeus and front very finely and closely, pro- and mesonotum, scutellum, except at base, and postscutellum closely and more strongly punctured, the punctures being sparser on the disc of mesonotum, and the base of the scutellum nearly smooth ; median segment finely longitudinally striate and reticulate ; abdomen minutely aciculate. Clypeus short, transverse anteriorly ; anterior ocellus not much larger than the others, with a distinct furrow from it to the base of antennæ ; median segment rounded posteriorly. Black ; the apex of 1st, whole of 2nd, and base of 3rd abdominal segments red, anterior tibiæ and all the tarsi more or less rufous ; pubescence greyish, moderately dense ; wings clear hyaline, nervures blackish, stigma dark testaceous, tegulæ black : radial cell long, 2nd cubital cell at top ⅓ the length of 3rd, and half the length of the space bounded by the recurrent nervures, which are received into the 2nd cubital cell so as to divide it into three nearly equal portions.

Hab.—Kashmir, 5,000-6,000 ft.

Length—7 mm.

Astata nigricans (Cam.).

Bingham states that there is a carina on the median segment. But there is no mention of this in the original description, nor is there any in my specimens. I have one which has the abdomen more or less red, but agrees otherwise with Cameron's description.

Tachytes.

This genus was common at Deesa, and I obtained a large number of specimens. The species are closely allied and difficult to discriminate. In the great majority the pubescence on the pygidium is golden in the ♀, and silvery in the ♂. Several species have been described from my specimens by Bingham, Cameron, and myself, but I have still a large number of specimens awaiting determination, for which the examination of the types of nearly all the species hitherto described from India will be necessary.

I have several stilopised specimens from Deesa.

Tachytes monetaria (Smith).

Bingham states that the wings of the ♂ have a distinct yellow tinge. He sent me two specimens from Rangoon as this species which were certainly not *monetaria*. In all my specimens the wings of both sexes are fusco-hyaline.

Tachytes proxima (Nurse, A. M. N. H., May 1903, p. 515).

I stated in describing this species that it was common at Deesa, but this is not the case, for I find that the males which I took to belong to my single ♀ apparently belong to another species.

Tachytes hospes (Bingh., J. Bo. Nat. Hist. Soc., Vol. XII., p. 119).

♂. Generally similar to the ♀, but smaller (12-15 mm.), and somewhat more pilose ; pile on front more approaching a golden tint, scape of antennæ red ; anterior femora with a deep emargination at base, median segment more coarsely striate, the striation transverse ; pubescence and pile silvery throughout ; wings lighter, though always with a slight fuscous tinge.

This species was fairly common at Deesa in June. I have a number of specimens, and I am satisfied that they are the same species, though the ♀ is considerably the larger. In the ♀ the abdomen is entirely without the pilose bands usual in this genus. The disc of the median segment is in both sexes without pubescence or pile, showing the striation clearly. Although the anterior femora are emarginate in the ♂, it is a *Tachytes,* and not a *Tachysphex.* It is very distinct from any other Indian species of the genus.

Tachytes opulenta, n. sp.

♀. Clypeus and front with the sculpturing hidden by the pubescence, except at the apex of the clypeus, which is rugosely punctured ; vertex, mesonotum, scutellum, postscutellum, and median segment very finely and closely punctured ; abdomen minutely aciculate, 1st ventral segment minutely and closely punctured, remainder shining, with scattered punctures, closely punctured at apex. Front with a distinct furrow not reaching the vertex, and with the usual smooth curved carina from each of the posterior ocelli towards the anterior ocellus ; distance of eyes apart at vertex equal to the 2nd joint of flagellum ; mesonotum with three longitudinal carinæ at base, not reaching the middle ; median segment short, roundly truncate at apex, with a median longitudinal furrow ending in a fovea where the truncation begins ; there is no trace of a furrow on the scutellum. Black ; clypeus and front, apices of 1—4 abdominal segments, apex of femora, the whole of the tibiæ, and the metatarsi covered with thick golden pile ; thorax with sparse greyish pubescence ; sides of abdomen and penultimate segment at apex with stiff black and testaceous hairs ; pygidium with black and golden pubescence intermixed ; wings flavo-hyaline, nervures and tegulæ testaceous.

♂. Similar, eyes separated only by half the length of the 2nd joint of flagellum, pubescence on pygidium silvery.

Tachytes astuta, n. sp.

♂. Head and thorax very closely and finely punctured, granular, abdomen minutely aciculate, ventral segments shallowly but somewhat closely punctured. Anterior margin of clypeus rounded, strongly depressed, with two blunt teeth on each side ; an impressed line from vertex to base of antennæ ; the ocelli of the form usual in the genus ; the distance apart of the eyes at vertex is less than the length of the 2nd joint of flagellum ; scutellum with an indistinct median impression ; median segment roundly truncate posteriorly, with a deep longitudinal impressed line along the posterior half of the segment : pygidium broadly rounded at apex. Black ; the palpi and mouth parts, calcaria, tibial and tarsal spines, and claws at base red ; scape of antennæ, clypeus and front with pale golden pubescence ; thorax, median segment, and basal abdominal segment with long pale pubescence, which has a golden tint in fresh specimens ; 1st abdominal segment at apex narrowly, and 2nd, 3rd and 4th broadly covered with silvery pile ; the pubescence on pygidium silvery ; legs with short golden pile. Wings flavo-hyaline, nervures and tegulæ rufo-testaceous ; the 1st recurrent nervure is received into the 2nd cubital cell near its basal angle, so that the space on the cubitus bounded by the 1st cubital and 1st recurrent nervures is less than half the space bounded by the two recurrent nervures.

Hab.—Jubbulpore : Mt. Abu ; Rangoon.

Length.—13-14 mm.

Near to *T. vicinus* (Cam.), but may be distinguished by the distance apart of eyes at vertex being less than the length of 2nd joint of flagellum, whereas in vicinus it is nearly the length of 2nd and 3rd antennal joints united.

Tachysphex.

The species of this genus are, like those of the last, closely allied and difficult to separate. I have a number of specimens from Quetta still awaiting determination.

Tachysphex instructus, n. nom.

Cameron has described two species under the names of *striolata* and *striolatus* respectively (Tr. Ent. Soc., 1903, p. 126, and J., Bom. Nat. Hist. Soc., Vol. XVIII, p. 305). For the latter I propose the name *T. instructus* to prevent confusion.

Tachysphex erythrogaster (Cam.).

The ♂ is generally similar to the ♀, but the 2nd cubital cell is narrower above, and the eyes are closer at vertex, being not further apart than the length of 2nd and 3rd joints of the flagellum united ; the pygidium is deeply and roundly incised at apex : the emargination at the base of anterior femora is wide but not deep.

Length.—8-12 mm.

Tachysphex selectus, n. sp.

♂. Head minutely and closely punctured : mesonotum, scutellum, and postscutellum less closely but more strongly punctured, median segment rather finely reticulate, abdomen minutely aciculate. Clypeus rounded anteriorly, front with an impressed line ; the distance apart of the eyes at vertex is about equal to the 2nd joint of flagellum, which is slightly shorter than the 3rd joint : anterior femora with a wide but shallow emargination at base ; median segment of the same length as the mesonotum, roundly truncate at apex ; abdomen with the apices of the segments depressed ; pygidium roundly and widely incised. Black ; all the tibiæ and tarsi dark red ; pubescence sparse, greyish ; pile on clypeus and front bright golden, on the legs and the apical margins of abdominal segments silvery ; wings hyaline, nervures and stigma piceous, inclining to testaceous about the base of the wings ; tegulæ rufo-testaceous ; 2nd and 3rd cubital cells subequal on radial nervure, 1st rather longer ; 1st recurrent nervure received into 2nd cubital cell before the middle, 2nd at the middle.

Hab.—Bombay ; October.

Length—8 mm.

Nearest to *T. testaceipes* (Bing.), but may be at once distinguished by the golden pile on clypeus and front.

Tachysphex peculator, n. sp.

♂. Head, mesonotum, scutellum, and postscutellum very closely and finely punctured, the mesonotum almost granular ; median segment very finely rugose, abdomen minutely aciculate. Front with a shallow furrow ; distance of eyes apart at vertex about equal to the 2nd joint of flagellum ; anterior femora scarcely emarginate at base, but with a slight depression; median segment about the length of mesonotum, roundly truncate posteriorly, the upper portion bounded at the sides and apex by a furrow; apical margins of abdominal segments depressed; pygidium roundly incised. Black; the mandibles reddish before apex; all the tarsi rufo-testaceous; apical margins of abdominal segments under the pile testaceous. Pubescence on clypeus silvery, on front rather long and dark fuscous; on thorax silvery and rather thick at the sides; abdominal segments 1-3 with somewhat wide bands of silvery pile; wings hyaline, nervures, stigma, and tegulæ rufo-testaceous; the 1st and 2nd cubital cells are subequal on the radial nervure, the 3rd shorter; the 1st recurrent nervure is received into the 2nd cubital cell before the middle, the 2nd after the middle.

Hab.—Deesa; November.

Length—12 mm.

This species is nearest to *T. testaceipes* (Bing.), but may be distinguished from it by the finely rugose median segment. From *T. selectus* described above it may be distinguished by the pubescence on front being dark fuscous.

Tachysphex heliophilus, n. sp.

♀. Clypeus sparsely, front and vertex closely and finely punctured: mesonotum rugosely punctured, granular; scutellum shining, sparsely punctured; median segment minutely reticulate, its apex transversely striate; abdomen smooth. Front with the usual furrow; the distance ot the eyes apart at vertex slightly greater than the length of 2nd joint of flagellum: median segment about the length of mesonotum, roundly truncate posteriorly; abdomen shorter than head and thorax united, pygidium with a few punctures. Black; the 1st and 2nd abdominal segments red; pubescence and pile short, sparse, silvery; calcaria and tibial and tarsal spines black. Forewing flavo-hyaline, with a light fuscous cloud across the radial. 2nd cubital, and discoidal cells; nervures and tegulæ rufo-testaceous; radial cell rather long, rounded at apex; the 2nd and 3rd abscissæ of radial nervure subequal, the 1st slightly longer; the 1st recurrent nervure is received into the 2nd ubital cell before the middle, the 2nd at the middle; hindwing hyaline.

♂. Similar, smaller, the pubescence on the front golden; the posterior tibiæ and all the tarsi more or less rufous: anterior femora emarginate at base.

Hab.—Deesa; February.

Length—♀ 7½ mm. ♂ 6 mm.

The only Indian species with a red base to the abdomen and a fuscous cloud across the forewing.

Tachysphex minutus, n. sp.

♀. Head, mesonotum, scutellum; and postscutellum closely and finely punctured; median segment longitudinally striate at base, transversely apex; abdomen aciculate, almost punctured. Clypeus transverse anteriorly, front with a shallow impressed line; the distance apart of the eyes at vertex is less than the length of the 2nd and 3rd joints of the flagellum united; median segment very short, about half the length of mesonotum, truncate posteriorly; abdomen as long as the head and thorax united, pygidium very long, sharply pointed with a few scattered shallow punctures. Black ; the mandibles, labrum, scape of antennæ, and apical 3 or 4 joints of the tarsi more or less rufous ; calcaria black, tibial and tarsal spines pale testaceous ; pile very short and sparse, silvery. Wings hyaline, nervures fuscous, tegulæ black ; radial cell very short, the 1st, 3rd and 4th abscissæ of radius subequal, the 2nd less than half the length of the others ; the 1st and 2nd recurrent nervures are received into the 2nd cubital cell before and after the middle respectively.

♂. Similar, smaller ; anterior femora slightly emarginate. pygidium deeply and roundly incised ; entirely black.

Hab.—Deesa ; January, September, October.

Length ♀ 7 mm. ♂ 5 mm.

Nearest to *T. striolata* (Cam.), but may be distinguished by the 2nd cubital cell being much smaller on the radial nervure.

Tachysphex ablatus, n. sp.

♀. Head and thorax very finely and rugosely punctured, abdomen minutely aciculate ; pygidial area impunctate. Clypeus almost transverse anteriorly, incised in the middle ; antennæ with 2nd and 3rd joints of the flagellum subequal ; the distance apart of the eyes at vertex less than 2nd joint of flagellum ; the apex of the median segment has traces of a furrow, and is obscurely transversely striate. Front, vertex, and thorax black ; scape of antennæ, clypeus, mandibles, except their tips, the whole of the legs and abdomen light red ; flagellum of antennæ blackish ; most of the tibial and tarsal spines pale testaceous, but a few are darker ; calcaria and claws dark red, sometimes almost black. Pubescence and pile silvery, thick but not very long on front and thorax, where it almost entirely hides the sculpturing. Wings hyaline, nervures and tegulæ rufo-testaceous ; the 1st and 3rd abscissæ of radius and the space bounded by the recurrent nervures are subequal : the 2nd abscissa of radius much shorter.

Hab.—Deesa ; June, August, September.

Length—11-14 mm.

Very near to *T. erythrogaster* (Cam.) in general appearance, but the eyes are much closer together at vertex.

Tachysphex gujaraticus, n. sp.

♀. Head, mesonotum, and scutellum very closely and finely punctured ; median segment rather obscurely longitudinally striate ; abdomen minutely aciculate, pygidium smooth. Clypeus almost transverse anteriorly ; 2nd and 3rd joints of flagellum subequal ; the distance apart of the eyes at vertex is rather less than the length of the 2nd and 3rd joints of the flagellum united ; median segment truncate posteriorly, with an obscure furrow. Red ; the flagellum of antennæ, front, vertex, and thorax, except the legs, black. Pubescence silvery, thick but not very long ; it usually hides the sculpturing of most of the head and thorax. Wings hyaline, nervures and tegulæ rufo-testaceous ; 2nd and 3rd abscissæ of radius and the space bounded by the recurrent nervures subequal ; radial cell rather short, truncate at apex.

♂. Similar, but eyes much wider apart ; anterior femora deeply emarginate at base.

Hab.—Deesa ; common.

Length.— ♀ 6 mm. ♂ 5. mm

Larra simillima (Smith).

This species was common at Deesa in June, and I have specimens from Mt. Abu and Jubbulpore The ♂ is very unlike the ♀, and has not yet been described, unless it is the form described by Cameron as *fuscipennis.*

♂. Head and thorax closely punctured, the extreme anterior margin of the clypeus smooth and shining, the vertex less strongly punctured than the front; mesonotum more strongly but less closely punctured than the median segment, on which in the centre above the punctures run into transverse striæ ; on the scutellum and postscutellum the punctures are finer than on the rest of the thorax ; abdomen very finely and closely punctured. Anterior margin of clypeus produced in the centre, with a slight median indentation, and emarginate on either side of the produced portion ; 1st joint of flagellum rather shorter than the two following united ; the portion of the front about the ocelli somewhat depressed ; mesonotum with a median longitudinal impression at base ; median segment roundly truncate posteriorly ; abdomen with the apical margin of the segments slightly depressed ; pygidium closely punctured, very slightly pubescent. Head and thorax with dense but somewhat short greyish pubescence ; antennæ, legs, and abdomen pruinose. Black ; the greater part of the first three abdominal segments dull red, apical margins of the remaining segments rufescent. Wings fusco-hyaline, almost hyaline at base ; nervures, and stigma brownish testaceous ; tegulæ shining testaceous, their margins punctured.

Hab.—Deesa.

Length.—11-14 mm.

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MISCELLANEOUS NOTES.

No. I.—A TAILLESS JACKAL.

While out riding this morning, I came across a Jackal (*Canis aureus*) without a tail. It crossed a country track some 20 yards in front of me and then stopped and stared at me. I was afforded a good opportunity of looking at it. It was in very good condition, with a sleek coat and on the fat side. I could not judge its sex, but if it was a bitch, I should say she was in pup. There was no sign of a stump of a tail, and the opinion I formed was that the Jackal had been born without a tail. After looking at me for a short while, the Jackal moved on and sat down under the shade of a milk bush, some 30 or 40 yards off, showing the greatest unconcern. I have seen a good many Jackals during my time in India, but I have never come across one without a tail before, so report it in case it may prove of interest to others.

R. M. BETHAM, Lt.-Col.,
The 101st Grenadiers.

MHOW, C. I., 18*th April* 1909.

No. II.—A FIGHT BETWEEN A HYÆNA AND A PANTHER.

Possibly the following may be of some interest to other members of the Society as throwing a side-light upon, to me at least, an unknown side of a hyæna's character.

I had had a goat tied up near a neighbouring hill on the chance of its containing a panther and heard yesterday morning that it had been killed by a hyæna. As it was probable that the latter would polish off any other goats we might tie up we decided to sit up for him, and accordingly my wife and I took up our position in a machan on the ground shortly after 6 p. m. We had not long to wait before the hyæna appeared and stood covered by some trees a little distance off. It seemed very uneasy and retreated more than once, always returning to the same spot where we had first seen it. Finally, just as it got dark, it moved off into the jungle on our left, and for some time there was silence. By this time it was quite dark except for a little feeble moonlight. Suddenly from our rear there was a rush and a panther bounded into the open glade in front of the machan, halted a brief second, and as suddenly bounded away again. In a minute it was back and sprang at the goat but missed it. I raised my gun to fire, but before I could get the sights on to it, it had seen the hyæna in the jungle close by, and with a roar sprang in the direction of the latter. A grand old scuffle then ensued—unfortunately out of our sight—which lasted for about ten minutes accompanied by much swearing and disturbance of the undergrowth. After it was all over the conqueror came to carry off the spoils of war, and to my amazement I saw that it was the hyæna and not the panther who had won the day. His triumph was however short-lived as I dropped him dead before he could reach the goat. The panther who all the time had never ceased to spit and swear did not seem in the least put out by the firing, and evidently thought that some wonderful intervention of providence had rid her of her foe, for, after about 15 minutes, she too proceeded to walk across my front towards the goat, enabling me to drop her dead within a few yards of her late antagonist. The panther turned out to be a female of about 5 years, measuring 6½ ft. The hyæna was also a female measuring 5 ft., 11 inches.

Personally I have never heard of a similar incident before, and it seems to me a most extraordinary thing that the hyæna should not only have stood up to the panther but should have worsted it to such an extent as to have practically robbed it of its dinner.

R. C. BURKE, Captain.

Sangli, S.M.C., 27*th Jan.* 1909.

No. III.—BREEDING SEASON OF THE COMMON INDIAN PORCUPINE (*HYSTRIX LEUCURA*).

I notice that in Blanford's *Fauna of British India* (Mammalia) the breeding season of the Indian porcupine is not specified, so that it may be of interest to note that a young male was brought in to me on the 27th of March by a pahari, who said he had found it in a rocky recess in these hills just below Almora. He said that he disturbed and flushed both parents from their fastness, and on investigating, found a solitary young one. This he supposed was about a month old. It measured when squatting about 9½ to 10½ ins. The spines were erected under alarm, but they were not yet stiff enough to inflict injury, and I handled the little creature freely. It was naturally timid, sought shelter, and when touched, while erecting its armature gave vent to a series of grunts.

Blandford says that two to four young are produced at birth, but there appears to have been but a single offspring on this occasion.

The altitude indicated is somewhere between about 4,000 to 5,000 feet.

F. WALL, C. M. Z. S.,
Major, I.M.S.

Almora, 29*th March* 1909.

No. IV.—THE SEROW.

In the *Field* of January 9, under Shooting, Mr. G. W. Bird, writing about sport in Burma, describes the Serow as a dark-red-brown animal weighing about 200 lbs., and other writers state that the colour of the Burmese Serow is rufous. Mr. Lydekker, for example, in his "*Game Animals of India*," states that the typical Sumatran species is more rufous generally than the Himalayan animal. Perhaps these writers may be describing specimens procured from Tenasserim, which may be of somewhat similar colour to the Sumatran species; but during a close acquaintance with the Serow in Upper Burma, extending over six years, I never met with this rufous variety, nor do I think that it exists there. The general colour of the animals shot by me and others has invariably been black above and brown beneath at all seasons of the year, and I should say that these were of the typical Upper Burman species. The following are the measurements and description of a female serow that I shot in the Northern Shan States in 1898.

The skin is sparsely covered with short bristly hair, 1½ in. long, the inner half of which is white and the outer half black. The cheeks, throat, knees, belly, and back of the lower parts of the legs are ruddy brown. The flanks ash brown. The nose, face, and horns jet black. The eyes are large, lustrous, and dark blue in colour. Hoofs black, very large and clumsy looking. A mane of strong bristly black hair 4½ in. in length runs from the nape of the neck to the withers. This mane is erected when the animal is excited. Its tail 5½ in. long is black above and ash brown underneath. Viewed from a distance of ten or twelve yards the animal seems to be wholly black in colour.

The measurements are as follows :—From crown of head along back to foot of tail, 4 ft. 3 in.; nose to tail, 5 ft.; height at shoulder, 3 ft. 6 in.; girth at shoulder, 3 ft. 7 in.; girth at flank, 2 ft. 10 in.; length of face, 10 in.; girth of fore leg at shoulder, 15 in., girth of fore leg above knee, 9 in; girth of fore leg below knee, 6 in.; ears, 8½ in.; horns, 8¾ in.; circumference at base, 4½ in.; weight when shot, 230 lbs.

This was an adult animal, and a large old male would stand 3 in. higher at the shoulder and weigh considerably more. One shot near Kyouklongyi, on the Bernardmyo Hkabine road, weighed a little over 300 lbs., and its horns were more massive.

This little known animal is found in suitable localities throughout the Northern Shan States, and it must be common in the Chinese Frontier States, for every mule driver has a serow's horn amongst the various articles attached to his waistbelt. It lives in families of four or five individuals in the most retired recesses of thickly wooded precipitous gorges, whose boulder-strewn slopes and shallow caves afford shelter from the weather, and may be found morning and evening feeding on the rank herbage of the more open slopes. One seldom sees more than one individual at a time, but I have seen as many as four feeding in different parts of one ravine within a few hundred yards of one another, and a sportsman on finding one Serow should always try the same gorge over again on the chance of finding another. They are most frequently found in the evergreen forest between 4,500 ft. and 6,000 ft., but they are also to be met with as low down as 800 ft. near Male Gale in the Ruby mines district.

Although of retiring habits, they are comparatively fearless of man, and their curiosity is such that they will often allow the sportsman to approach fairly near them before dashing off. When shot and missed, they do not travel far. On one occasion I found and missed an old buck, followed him up, and killed him within fifteen minutes, although he saw me when I first shot at him at a short range. The Serow will not run from a dog, and the Leeshaws take advantage of this characteristic. They hunt it with a trained dog, which holds it at bay, whilst they sneak up quietly and shoot it at close range with their cross bow and poisoned arrows.

Although known as a wild goat, in appearance it is more like a cross between a deer and a donkey, being heavy and unwieldy in front, with high withers sloping very much towards the hind quarters. Its favourite pose is to stand on the top of a rock with forelegs astraddle and head held low. It is very difficult to distinguish the sexes at a distance. Their movements very much belie their appearance; they are exceedingly active animals, not only amongst rock, but also on the flat. When disturbed they usually dash off down hill, with a deep hissing snort or two, into thick cover, and as a rule they circle round any, reascend the hill behind the intruder, posting themselves on some coign of vantage, from the safety of which they can watch the hunter tracking them. Before I knew of this dodge I often tried to drive them without success, having one several times in a beat, but never succeeded in getting it to cross the guns.

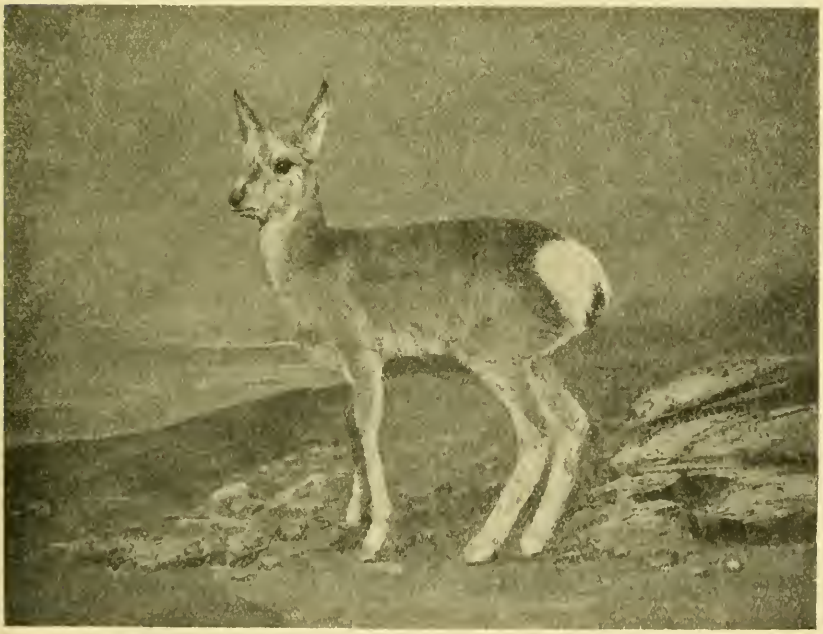
In stormy and wet weather they are very restless at night, and call to one another a good deal. Their call is a whistling scream. The female usually brings forth one kid at a birth and sometimes two, about the end of September, and the kid runs with its mother for a year. On two occasions I have seen a mother with a very young brown coloured kid and a half grown kid in attendance. The period of gestation is about seven months.

A sure find for Serow is the gorge of the Pyoung (Goung) stream, a mile below the now abandoned military station of Bernardmyo, in the Ruby mines district.

H. SHAW DUNN.

ANNANHILL, KILMARNOCK.

(*The above appeared in the* "*Field*" *of* 30*th January* 1909.)



No. V.—NOTE ON A YOUNG TIBETAN GAZELLE.

I am sending you a photograph of a young male Tibetan gazelle (*Gazella picticaudata*). I have often noticed that sometimes the white round the tail of these animals appears much brighter and larger than at other times. This is very noticeable in bright sunlight when the white can be seen at a great distance.

By watching this animal in captivity I found that when alarmed the white hair would bristle outwards in a peculiar way giving this effect.

F. M. BAILEY, Lieutenant.

Gyantse, Tibet, *25th August* 1908.

No. VI.—COLOUR VARIETY OF INDIAN HOUSE CROW.

I send herewith the skin of a common Indian House Crow (*Corvus splendens*) shot in the Jullundur district, Punjab. Its colouring is so strange that I hope it will be of interest to the Society's Museum.

L. C. GLASCOCK.

Phillaur, Punjab,
19th February 1909.

[The specimen sent is curiously coloured, being dark cinnamon on the head, throat, wing coverts, and abdomen, the remainder being pale cinnamon. In the Society's collection there is a specimen coloured in the same manner but paler on the neck. There is also a skin of a beautiful creamy white specimen obtained in Bombay.—Eds.]

No. VII.—ON THE OCCURRENCE OF CERTAIN BIRDS IN THE DARBHANGA DISTRICT, TIRHUT.

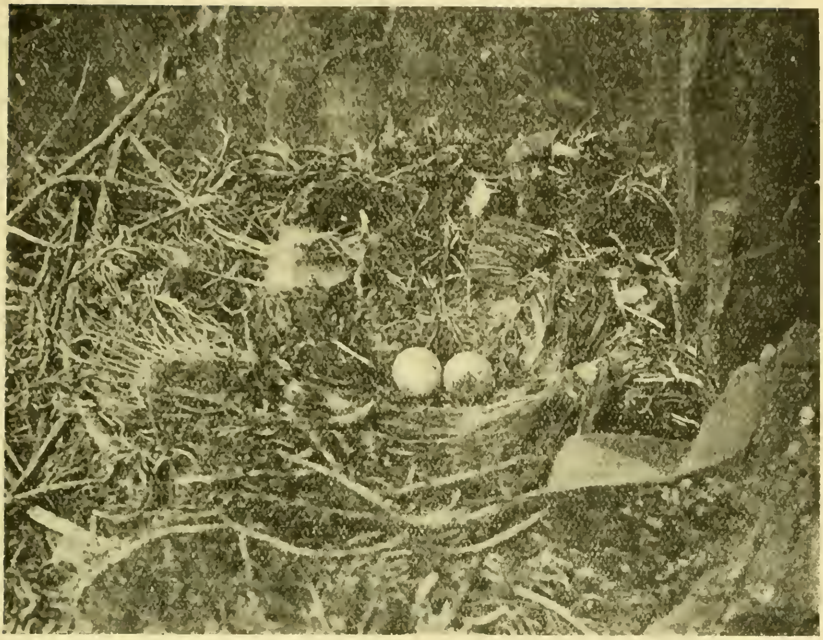
On the morning of the 4th February, my shikari brought me in a bird, which I found to be *Chibia hottentotta* (The Hair-crested Drongo) shot within three miles of the Factory. I have found this a most uncommon bird in this district.

On the 11th of the same month, my collector brought me in a male of *Emberiza pusilla* (The Dwarf Bunting). He says it was all by itself but I daresay he overlooked its mate. This bird has been recorded from Purneah by Jerdon, but that is the only occurrence in the plains, according to Oates in the Fauna of British India, Vol. II, and so its turning up here is an interesting fact.

I recorded the occurrence of a single *Vanellus vulgaris* (Lapwing) in this district on the 8th August 1903 (see Jour., Bom. Nat. Hist. Soc., Vol. XVI, page 74) and have now to record another specimen being procured, but this time near Jainagar in the Madhubani Sub-division. Both specimens are in my collection.

CHAS. M. INGLIS.

Baghownie Factory,
Laheria Serai, *11th February* 1909.



No. VIII.—A NEST OF *ARCHIBUTEO HEMIPTILOPUS* (HIMALAYAN ROUGH-LEGGED BUZZARD) FROM TIBET.

I send you a photograph of a nest of *Archibuteo hemiptilopus* which I took near here on the 19th April this year at an altitude of 14,800 feet. The nest was made of sticks (one of which was over five feet long) and lined with blades and roots of coarse grass. The Tibetan name for this bird is "cha kyi." It feeds on hares and snow cock (*Tetraogallus tibetanus*) which were very plentiful in the vicinity of the nest, and it is also said to do some damage to the flocks by taking young lambs.

F. M. BAILEY, LIEUT.

GYANTSE, *10th September* 1908.

[A skin of this rare Buzzard has been presented by Lieut. Bailey to the Society's Museum. The specimen is a male and answers closely the description given by Mr. Hume of a "presumed male" in "*Stray Feathers*," Vol. iv, pp. 370-371.

The measurements of Lieut. Bailey's and Mr. Hume's specimens are as follows:—

	Wing.	Tail.	Tarsus.	Bill from gape.
Lieut. Bailey's specimen	18·6	11·5	3·1	2
Mr. Hume's "	19·	11·	3·1	2

N. B. KINNEAR.]

No. IX.—DOVES NESTING ON THE GROUND.

Yesterday, the 3rd March, I found two nests of the common dove (*Turtur tigrinus*) built on the ground.

The first I found in the morning whilst inspecting a timber cutting in the Kyangin forest reserve. It was on the ground, right out in the open, under a teak tree and was of the ordinary kind, just a few twigs collected on some fallen leaves. There was no attempt at concealing the nest. There were two eggs in this nest, freshly laid.

The second nest I found the same evening. It was placed at the foot of a catechu (*Acacia catechu*) tree not far from my camp. The bird flew off as I approached the tree. There were two eggs in this nest also freshly laid.

In all my wanderings in Burma and India I have never before come across doves nesting on the ground and cannot account for these, as there were lots of trees and bushes about them to build on. I should like to know whether the nesting of doves on the ground has ever been recorded before or not. It seems strange that they should pick the ground to build their nests, as the eggs or young are almost certain to be destroyed by snakes or cats.

C. W. ALLAN.

HENZADA, BURMA, 4*th March* 1909.

No. X.—NIDIFICATION OF THE SARUS CRANE (*GRUS ANTIGONE*).

To-day, while snipe shooting at Talod, I came across a Sarus chick just hatched out. The egg shell was lying along side it. I thought Sarus laid during the monsoon ? I should like to know if this is the usual time for nesting. The behaviour of the parent birds was curious. My shikari had to pass within five yards of the nest to pick up a snipe, but the parent birds, who were feeding twenty yards off, took no notice of him at all, though one of them uttered a low growling note once or twice. I went on and called my wife who was waiting for me a short way off, to see the chick. My wife and I with my shikari and three beaters walked up to within ten yards of the nest. The parent birds were feeding about 50 yards off and did not appear to notice us. My shikari and I then went up to the nest and handled the chick. Even this had not the effect of causing the parents any anxiety. The chick was an ugly little thing, like a big gosling, and was very unsteady on its legs and would only waddle about slowly. When I first left the neighbourhood of the nest, to call my wife, I noticed the parent birds move up close to it for no apparent reason, but shortly after a kite swooped down near the nest and there was a charge of two infuriated sarus at the kite immediately. The nest was quite exposed and the parent birds evidently knew their enemy, but it was certainly extraordinary that they did not mind our handling the chick and continued feeding unconcernedly while we stood by their nest.

E. O'BRIEN, CAPT.,
Asst. Pol. Agent.

CAMP TALOD, SADRA,
MAHIKANTHA, 12*th February* 1909.

No. XI.—ALBINO SNIPE.

When shooting with Mr. W. V. Nicholas at Pithoro in Sind last week he shot a partially albino full snipe (*Gallinago coelestis*). The head and neck, back primaries and breast are white, tinged and barred in places with rusty yellow. The wing coverts are of the usual colour. Mr. Nicholas has presented the specimen to the Society's collection.

H. GILL.

BOMBAY, 24*th February* 1909.

No. XII.—FLAMINGOS IN THE N.-W. FRONTIER PROVINCE.

On 21st of October last I saw a large flock of flamingos flying east down the Kabul River. They were flying quite close down and were unmistakable, but it was early in the morning and few saw them. They were about 500. They were the large Flamingos (*Phœnicopterus roseus*). On the 7th instant I saw another large flock flying west up the Kabul river and again more on the 8th, possibly parts of the same flock. I mentioned it to Captain Bogle of the Guides, who has lived at Mardan for some years, and he told me that he had never heard of them in this province. However he told me yesterday that within the last few days several birds have been seen in the neighbourhood of Mardan which are undoubtedly Flamingos. The dates may be of interest. This would seem to be quite a likely route for them on their migration, but I have never seen them except on the dates mentioned.

W. P. C. TENISON, R.A.

NOWSHERA, 16*th March* 1909.

No. XIII.—OCCURRENCE OF THE BAIKAL OR CLUCKING TEAL (*NETTION FORMOSUM*) IN THE PUNJAB.

I am sending for the museum a teal which, as far as I can make out, is the Baikal or Clucking Teal, and if I am correct in my identification this will make the fifth authenticated specimen shot in India.

The bird was shot by Mr. A. B. Aitken, of the Irrigation Department, close to the Behranwala Canal escape, Lyallpur District, on 6th February 1909, and sent to me for identification. Mr. Aitken has kindly given me the skin for presentation to the Museum if it is of any use to you. The skin had unluckily been dressed with salt before I got it, and it may be rather difficult to preserve now.

The skin agrees with the description of the Clucking Teal given in "Indian Ducks and their Allies" with the exception of the head which is not black, the back also is not quite the same nor the colouring of the feet, but they may have changed colour before I got the skin, otherwise the feathering corresponds.

J. LINDSAY SMITH, CAPT.

LYALLPUR, PUNJAB, 26*th February* 1909.

[The Specimen proves to be a Baikal or Clucking Teal (*Nettion formosum*) and has been added to the Society's Collection.—EDS.]

No. XIV.—OCCURRENCE OF THE BAIKAL OR CLUCKING TEAL (*NETTION FORMOSUM*) IN NORTH BEHAR.

I find on page 164 of Mr. Baker's book on "*Indian Ducks and their Allies*" that there is only one recorded instance of the Baikal or Clucking Teal being found in India, since the year 1898.

It may interest you to know that a male Baikal Teal was caught in Muzuffurpur district (in North Behar) towards the end of the cold season of 1907.

It was brought by some professional fowlers to Mr. H. de Vitre, of Runi Syedpur Indigo Factory, and kept by him in his tealery. I was able to identify it as a Baikal Teal, by means of Oates' book "The Game Birds of India." The bird was one of a pair but its companion had died before I happened to arrive at the Factory. Mr. de Vitre had the bird mounted by a Calcutta firm, but unfortunately it was completely spoilt by them.

G. J. MONAHAN, I.C.S.

STILLORGAN PARK,
BLACKROCK, CO., DUBLIN,
IRELAND, *9th March* 1909.

No. XV.—INTELLIGENCE IN BIRDS.

Having read a letter on the "Injury feigning habit of parent birds," in which the writer on pages 916, 917, and 918 of Vol. XVIII of the Journal discusses the point as to whether the birds are acting in such cases by instinct or with intelligence, I should like to record the action of a tame Magpie, which belonged to me, and which I think certainly showed "intelligence" of a very high order. The bird in question was *Pica bottanensis,* the black rumped Magpie, which is so similar to the common European Magpie, *Pica rustica*, that it is really only an Eastern form of that species. I took the bird out of the nest in July 1893 in a high valley in Ladakh and took it down to the plains of India with me. The bird was so tame that I allowed him the free use of his wings, which I never cut, and he flew about the bungalow, inside and out, as he liked. At a station in Central India, when I was on detachment with Capt. M. of my regiment, in 1894, I being then a subaltern myself, he and I and a Captain of the R. A. M. C. occupied one bungalow together. The R. A. M. C. Captain had two very fine bull-terriers, a dog and a bitch, with which the Magpie was on very friendly terms, and they never molested him in any way. One day in the hot season, Capt. M. called to me from the dining-room, saying: "Come over here quietly and see what your Magpie is doing." I went over to him and he took me to the door by the front verandah. We saw the Magpie walking round the two bull terriers, examining both very closely for some time. We could not understand at first what he was driving at, but from what followed it was quite evident that he was trying to ascertain whether the two dogs, which were lying full length in the shade in the verandah, were really asleep or only dozing. Having satisfied himself that both were asleep, he deliberately walked up to the dog, and gave him a couple of very hard vicious digs in the tail with his beak, and then disappeared like lightening round one of the thick mud pillars of the verandah. The dog sprang to his feet with a growl, waking up the bitch, who also jumped up, and both dogs stood about in the verandah uneasily for some time looking for something on which to vent their anger, the magpie all this while keeping himself well out of view. Finally the dogs got drowsy again, lay down in the verandah, and went to sleep again. When all was quiet we saw the magpie come very cautiously from his hiding place. Again he carefully scrutinized the dogs to see if they were asleep, and then he repeated the performance, biting the dog again in the same way as before, and again disappearing like a flash round the thick pillar of the verandah. This time however the dogs were so uneasy, that they would not lie down again. We saw the magpie wait in his hiding place for some time, and then seeing that the game was up, he hopped down on to the gravel walk about 18 inches below the verandah. We then lost sight of him for a few minutes, but he soon reappeared flying down from a big tree at the other side of the house, and settled close to the two dogs, with a chatter as if he was greeting them for the first time that morning. It was evident from the way the dogs received him that they had no suspicions as to his being their assailant while they were lying asleep. In order to fly down into the verandah from the direction he came, he must have gone right round the bungalow on the gravel walk keeping close to the wall to keep out of view, then at the back of the bungalow got up into the tree, and then flown down to the verandah to talk to his friends, the two dogs, as he very often did. They were therefore not the least surprised when he flew down to them, as they were accustomed to see him doing so very often. The barracks were fully half a mile from the bungalow and the magpie always flew there directly he was let out of his cage in the morning, remaining with the men till their breakfast was over, when he used to fly back to the bungalow and get morsels from our breakfast table. At night he always went into his cage of his own accord, the door being put open for him, and it was shut by my servant, when he had gone in, and opened again every morning at daylight. This bird was a constant source of amusement to us, frequently showing what I think was great intelligence, but I think his little joke with the two bull-terriers was his most amusing exploit. He must have thought this out deliberately, and not the least amusing part of it was the way he coolly presented himself to the two dogs as if he was saying "good morning" to them after having just perpetrated a cunning piece of treachery on his unsuspecting friends. If that does not show intelligence I do not know what it should be called. It was a deliberately planned practical joke, admirably carried out, and the perpetrator screened himself cunningly from detection by his victims.

H. DELMÉ RADCLIFFE, Major, F.Z.S.,
Royal Welch Fusiliers.

Sports Club, London, *4th February* 1909.

No. XVI.—ON THE HABITS OF BIRDS WHEN DANGER—SUPPOSED OR OTHERWISE—THREATENS THEIR NESTS.

I have been much interested lately in the letters which have appeared in the Miscellaneous Notes of the Society's Journal regarding the behaviour of birds when danger threatens their nests. I think the following incident concerning a Fiscal Shrike (*Lanius collaris*) may be interesting. In this particular case reason was conspicuous by its absence, and instinct disastrously misleading but the intention of the bird was perfectly clear. As I am sending this to a Journal on the Natural History of India in response to the trust expressed by Mr. Dewar, in his article, dated 10th September 1908, that members will let the Society have the benefit of their observations on this subject, I ought to say that the bird was not an Indian one, nor did the incident come under my observation in India. Nevertheless as an example of absolute stupidity, clearly demonstrating that this particular bird at all events possessed no reasoning powers, I hope that it may help to throw some more light on this interesting subject, as after all the habits of birds of the same species in different countries are more or less alike.

When we were living in Middleburg, Transvaal, a pair of Fiscal Shrikes had begun to build their nest in a small group of trees not far from the road leading to our bungalow.

We frequently walked past the place of their choice, but would never have found their nest, which was quite invisible from the road, had it not been for our dog, a pointer.

The group of trees was enclosed by an iron fence, and some time previously our dog had found and chased a cat inside the enclosure, with the lasting result that it could never pass that place without at once searching it thoroughly for the same cat, which I need hardly say was never to be found there again. One day in September 1906 whilst returning home from a walk with my wife, our dog, on nearing the small plantation of trees, as usual rushed on ahead, entered the enclosure and began to hurriedly search for cats in the long grass. When it had gone a little more than half way through, a shrike suddenly flew out from one of the trees and violently scolded the unintentionally offending dog. On the next and every subsequent occasion that we passed the place, the bird used to fly out at the dog long before it was anywhere near the plantation, and behave in a most absurd way chattering and scolding, and following the dog, flying a few feet above its head, until it was past the enclosure. The dog never used to take the least notice of the bird, and the bird apparently did not object to us. We could have walked about among the trees all day long without apparently causing any alarm, but the poor dog which had never climbed a tree in its life, was not even allowed to pass the place on the side of the road opposite to the trees without being molested.

This curious behaviour on the part of the bird naturally led me to suppose that its nest was somewhere in the plantation. I therefore made a systematic search, starting at one end of the plantation, and walking backwards; and forwards examined carefully every tree. In about a quarter of an hour I found the nest some ten or twelve feet above the ground, built close against the trunk of one of the trees (a Blue Gum). I was unable to climb the tree as the branches were too thin to support my weight, so I hurried back to my bungalow for some ladders, expecting after all the fuss the bird had made to find at least young birds. I was quite wrong, the nest was only half built. Thinking that perhaps this was not after all the nest belonging to the shrikes which objected so much to my dog, I searched in every other tree in the plantation, but could not find any other nest. To make quite certain I went out the next day alone and watched, and I saw both birds frequently fly in and out of the tree which contained the half built nest.

Now, had the bird been capable of exercising any intelligence, would it have constantly drawn our attention to the whereabouts of its nest, by scolding a dog which never took the least notice of its ridiculous antics? The first time it might have been suddenly frightened by the appearance of a strange monster under the tree it had selected for the home of its future young, and involuntarily cried out, and attempted to drive it away, in the same way that a very young child will involuntarily cry out when suddenly alarmed, even at objects which are quite inanimate and obviously to us, could not possibly do it any harm.

Why then should it after the first time of seeing the dog, when it discovered that it took absolutely no notice of it, and never attempted to touch its half formed home which was out of reach, continue day after day to attack the dog (sometimes long before it was even near the plantation) which it would have known had it been able to reason, could not climb trees, was obviously looking for something on the ground, and thereby draw the attention of two humans who could climb trees?

There was certainly no intelligance exhibited by this bird, neither can I believe it was solely instinct which so disastrously misled it to expose the one place it wished to conceal.

I think that in this case the bird must have been in the first instance so intent on doing something to its nest, that it neither saw nor heard the dog approach the tree it was building in, and then suddenly catching sight of it beneath, was so frightened that whenever it saw the dog again, associated it with something to be alarmed at, in the same way that the dog always associated that particular enclosure with a cat it had once discovered there, but never subsequently found there again.

My opinion of the above is comfirmed by the fact that, at about the same time in a disused compound about a quarter of a mile away, another pair of shrikes behaved in exactly a similar way, but on this occasion devoted all their attention to us, and left the dog severely alone. In the former case had the bird been able to reason, although instinct prompted it to behave as it did, it would have suppressed its fright for fear of attracting our attention to its nest, being the ones who could do it real harm, and on finding that nothing happened, would have kept quiet on subsequent occasions.

In the latter case the behaviour of the birds was exactly the same, but the whole of their attention was directed to us, and not at all to the dog, which conclusively proves to me that these birds at all events are led by a common instinct to attract attention from their nests in one particular way under any circumstances of danger, real or supposed.

In eight years' experience of birds' nesting, and observing the habits of birds during the period of nidification, in India, Burma, and South Africa, I have never once seen a bird show the least intelligence, nor has a single incident ever come under my notice which has ever made me even suspect that birds are capable of reasoning.

I think each species possesses hereditary instincts of its own to conceal its nests, and attract attention from its chosen sites, but has not the reasoning powers to use them intelligently under varying circumstances.

I was also very much interested in Mr. C. H. Donald's description of the injury-feigning incident of the black partridge, which came under his observation. I have found many nests of game birds, but have never met with a single incident of these birds feigning an injury, although I have noticed it in all the other birds mentioned by him except the woodcock. The fact, however, that partridges do adopt this method for attracting attention from their young has been known for many years. Gilbert White, when writing from Selborne on the 26th March 1773 to the Hon'ble Daines Barrington on the ~~στοργὴ~~ of στοργ animals, remarks :—

" Thus a partridge will tumble along before a sportsman in order to draw away the dogs from her helpless covey."

In another place he writes :—

" A hen partridge came out of a ditch, and ran along shivering with her wings and crying out as if wounded and unable to get from us. While the dam acted this distress, the boy who attended me saw her brood, that was small and unable to fly, run for shelter into an old foxearth under the bank. So wonderful a power is instinct."

An incident once came under my notice of the Madras bush lark (*Mirafra affinis*) feigning injury. One day whilst walking down the British Infantry rifle range at Meiktila in Burma, I struck at a piece of a chatti lying on the ground, with my walking stick. I was surprised to see a small bird run out from beneath it, and run along for some distance with an apparently broken wing. At first I thought it really was wounded, and had taken shelter under the piece of chatti from the heat of the sun, but when it eventually rose from the ground and flew away I knew at once what was up, and on turning over the piece of chatti discovered a nest containing three eggs.

STANLEY PERSHOUSE,
2nd Border Regiment.

THE HALL, STRENSALL, YORKSHIRE,
10*th February* 1909.

No. XVII.—THE INJURY-FEIGNING HABIT OF PARENT BIRDS.

As I said in my original letter (Vol. XVIII, p. 680), I knew I was treading on delicate ground when I suggested reason rather than instinct to be the explanation of the strange behaviour of a bulbul (*Otocompsa emeria*), when it thought its nestlings in peril. I cannot regret having done so now that my surmise has provoked Mr. Dewar to write on the subject. He is always worth listening to, and his letter on this subject is particularly interesting. He will doubtless forgive my endeavouring to support my contention in this case.

Of course, the whole question is one of terms. What is instinct? What is reason? An "instinctive action" I take to be the impulse arising from the experiences of the moment, *i.e.*, before one's brain has time to reason consciously, what in fact is termed "reflex action" in certain cases. Unwittingly I put my hand on a hot iron, instinctively I withdraw it. No effort of reason is required. When I find that the pain of the burn remains I apply remedies. This subsequent action being the result of reason.

In Mr. Dewar's letter (Vol. XVIII, p. 918), he impugns the logic of both my Bulbul and his Babbler, but that to my mind does not disprove the attempt to reason. Darwin in his "Descent of Man" instances the case of the retriever and the wounded duck as a distinct attempt to reason, although, as he says, the animal's logic was hopelessly wrong, in fact quite as much so as my Bulbul's.

The way I regard the matter is this. The birds were accustomed to see me looking frequently at their nest, and had realised that there was no reason to fear me. When, however, a stranger came on the scene—a new experience—they started scolding or threatening us. This failed to have the desired effect, and here, it seems to me, the bird, by changing the tactics prompted by the impulse of the moment, shows that it must have reasoned something like this:—"My scolding has not succeeded in driving these marauders from my nest, I must try some other course. If they are after birds I will lure them from my young, by making them think they can easily secure me." From this resolve came the wonderful mimicry of a badly maimed bird.

It has always seemed to me to be a bit of human arrogance to claim reason and a future existence for mankind, and to deny them to the brute creation. No doubt the evolution of reasoning powers in man has been more rapid than it has been lower down the scale, and there are obvious gradations in the human ability to reason, but there are on record instances of reason in animals and birds which cannot be assigned to instinct. Take the very elementary case of the puppy. He wishes to relieve his full bowel; instinct teaches him to do so forthwith. If he is in the garden at the time nothing happens to him for obeying this impulse of nature, but, if he is in the house, his owner at once proceeds to show him that his action is not appreciated. This happens two or three times, and then the puppy has learnt a lesson he remembers all his life. Either his master's castigation has got the better of the animal instinct, or the dog has reasoned that as he always gets punished when he relieves nature indoors, and never when he does so out of doors, he had better avoid doing the first for the future. I prefer to think that the latter has happened, that reason has triumphed over instinct. Many of your readers will remember the case of the broken legged stray dog who was treated in a London hospital (between twenty and thirty years ago, I think) and who subsequent to his discharge therefrom reappeared one day at the hospital with a broken legged canine friend. The incident gave rise to considerable discussion and correspondence at the time under the head of "Reason or Instinct."

As regards Mr. Dewar's experience with his Babbler, undoubtedly the birds did not reason correctly, but that they attempted to reason seems to me no more unlikely than that Darwin's historical retriever did. Had the Babbler been actuated only by instinct it surely would have gone on feeding its young, the primary instinct of all creation to its progeny. I am only endeavouring to give a possible explanation of the bird's behaviour and have no intention of dogmatising. The train of thought may have been something like this,—"Here's an intruder! Better wait a bit and give him time to go on, before I expose the whereabouts of the nest. I might try a little scolding too; it is so successful with mongooses, snakes, and other avian annoyances. He does not seem to mind the scolding, and shows no disposition to move on, and I simply cannot let the children starve, so I'll risk it." Up to this point it appears to me that reason is a *possible* explanation. That the subsequent action betokened a fault in the logic of the bird does not actually disprove the previous attempts to reason. The babblers may have put down Mr. Dewar's merciful restoration of their fledgling to "funk" induced by their threatenings and scoldings, and have flattered themselves that a pursuance of their former successful tactics was all that was required to save their young!

I am not suggesting all this so much with the view of attacking Mr. Dewar's theories, as with the idea of defending my own. His may be the most likely explanation, but it is not the only possible one. I had only wavered between instinct and reason; he has introduced a third explanation which might almost be termed hysteria.

ARUNDEL BEGBIE.
February 1909. MAJOR.

No. XVIII.—EXTENSION OF THE HABITAT OF THE COMMON KUKRI SNAKE (*SIMOTES ARNENSIS.*)

Through the courtesy of Major H. A. F. Magrath I have recently examined two specimens—one adult, one very young—of *Simotes arnensis* from Bannu on the North-West Frontier. Though this species is fairly common in the Plains of Peninsular India up to the low foot hills of the Himalayas, it has only once been reported outside the Oriental Region, a specimen from Deesa being in the British Museum. Although it has never been reported from the Basin of the Indus it must occur there, since it is now known to extend to the North-West Frontier, this locality very largely increasing its previously known range of distribution. Both specimens conform to variety A of Boulenger's Catalogue, *i.e.*, have the belly unspotted. The ground colour is biscuit or buff, and there are the usual narrow blackish-brown crossbars dorsally breaking up more or less laterally. The adult is a ♀ measuring 1 foot 7½ inches, the tail accounting for 2⅞ inches. The ventrals are 194 ?, the anal divided and the subcaudals 45. The scales are, as is usual in this species, 17 anteriorly and in midbody, 15 at a point two heads-lengths before the anus. The supralabials are abnormal, *viz.*, 6 with the 3rd and 4th touching the eye but the last shield is fairly obviously a fusion of the normal 6th and 7th. There are 42 bars on the body and 12 on the tail. The three dark chevrons on the head are very conspicuous, well defined, and quite discrete.

The young specimen, which I have sent to the British Museum, is similar except that the ventrals and subcaudals number 199 + 48, the supralabials are 7 and the crossbars 39 + 12. The length is 6¾ inches.

F. WALL, C.M.Z.S.,
MAJOR, I.M.S.

ALMORA, 11*th May* 1909.

No. XIX.—DISCOVERY OF A SECOND SPECIMEN OF THE RARE SNAKE *OLIGODON ELLIOTTI.*

Among the specimens identified as *Oligodon subgriseus* in our Society's collection which have been recently sent me I have discovered one of *Oligodon elliotti.* As only one other specimen of this rare snake is known, *viz.*, the type from the Madras Presidency which is in the British Museum, the discovery is an interesting one beside being a valuable one in the interests of our Society. The specimen accords well with Gunther's (Rept. Brit. Ind., p. 207., and Plate XIX, fig. G) description and figure. The only things to remark upon being that the second chevron on the head does not become confluent with the nuchal one. It extends bowed forwards beneath the chin however as in the type. There are 34 spots along the body. The ventrals and subcaudals are 149 and 31 and the anal shield is divided. It measures 1 foot 1½ inches, the tail accounting for 1⅞ inches. The locality given with this snake is Ceylon, but there is no record when it was received or by whom it was presented.

F. WALL, C.M.Z.S.,
MAJOR, I.M.S.

ALMORA, 13*th April* 1909.

No. XX.—A CASE OF HORNET POISONING.

In Vol. XVIII of this journal (p. 694) Captain MacWatters reports three cases of hornet stings. In this connection the following case will be interesting. On the 10th December Major H. whilst out shooting was attacked by hornets.* Being unable to rid himself of them he lay down with his arms round his head to protect his face, thus rendering only the back of his head and neck vulnerable to their stings. Four settled on the scalp and neck inflicting stings, which smarted pretty severely, but not so much as to prevent his continuing shooting in a few minutes.

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* In spite of repeated efforts I have failed to get a specimen for identification.

In about ten minutes' time he suddenly felt queer, handed his gun to his orderly and tried to speak but could not, though he made strenuous efforts to call out. He then fainted away. Major E., his companion, came to his assistance, and found his face livid, eyes bloodshot, and his nose and ears blue. His hands were cold and blanched and he could not find his pulse. On regaining semi-consciousness he complained that he could not see. A state of semi-consciousness lasted for about half an hour. On fully regaining consciousness he complained of intolerant itching all over the body, and Major E. then discovered he had a rash all over the abdomen. He then vomited. After a few minutes he walked to camp with assistance. Severe diarrhœa set in at about 7 p.m. and lasted all night and he vomited again in the night. He noticed too that his penis and scrotum were considerably swollen but not painful. The next morning he felt well enough to continue shooting and had no recurrence of untoward symptoms.

The paharis who were beating recommended lime-juice for the stings, and procured limes from a neighbouring village. Major E. squeezed and rubbed the juice into the wounds which he says were visible as pink, shiny, small, round areas, not in the least swollen. He gave whisky internally, and covered him warmly. The case is a very interesting one. The rapidity with which the symptoms set in, and the profound prostration of the sufferer show that these insects secrete a most virulent poison when they sting.

The poison appears to me to have operated in two ways. Firstly upon the nervous system, and the full force of the neurotoxic agent appears to have fallen upon the heart.

There appears, too, to have been a toxic influence reducing the coagulability of the blood, hence the rash which was probably a nettle rash, and the œdema of the genitals. The only other possible solution of the blood state, is by assuming an absorption of citric acid from the lemon juice applied locally. There seems little doubt that had one or two more stings been inflicted the case would have ended fatally.

F. WALL, C.M.Z.S.,
MAJOR, I.M.S.

ALMORA, 16*th December* 1908.

No. XXI.—THE BLOOD-SUCKING PROPENSITIES OF A BUG (*NABIS CAPSIFORMIS*).

While sitting outside one evening, about nine o'clock, in the middle of April, my attention was attracted by a sharp prick on the back of one of my hands. On looking, I saw a small bug busily employed with its proboscis through the skin. So engrossed was the bug that it did not move, though I walked into the bungalow, and out again, before putting a tube over it.

Mr. Lefroy, to whom I sent the insect, writes that it is a specimen of "*Nabis capsiformis* one of the Reduviids, it normally feeds on caterpillars." The fact of it sucking blood is therefore perhaps worth recording. According to Mr. R. M. Dixon "The blood sucking propensities of some of the species are, I believe, due to a habit acquired probably for the purpose of self-defence."

N. B. KINNEAR.

BOMBAY.

No. XXII.—NOTES FROM MANSI, NYU FOREST, UPPER BURMA.

An elephant having died from old age was buried as customary in a pit with bamboos placed over it and earth over that. Passing that way about 10 days afterwards I was attracted by a frightful smell and discovered that the thigh of a hind leg had been disinterred and gnawed to the bone by (presumably) bears, as there were bear tracks all round, and no signs of another animal. This is, I venture to think, an unusual occurrence.

There is a simple and effective method of catching fish up here which deserves notice. A dam is made in the rocky creek (the water of which at this time of year is only some 15 ft. wide as against 50-60 in the rains) above a pool where fish are seen; this is made with bamboo stakes and bottomed with bamboo lattice work. Another is then made lower down, with the same bottom, but above the surface of the water the poles are long and sloped down stream at an angle of about 65 degrees. From these poles are then hung rugs, cloths, etc., the bottoms of which are fastened to the lattice frame work at water level, so that they then bag like sails with the water rushing in at the base. The men then go up to the top dam above the pool and work down with spears, stones and torches (it is best done at night) and little rafts of fire, making a terrific noise; the frightened fish rush down stream and seeing only the lattice frame jump into the bags of cloths, whence they can be removed after the beat. The first night I saw it done, we got 48 fish weighing from a few ounces to 2 lbs.—I believe mahseer—but am very ignorant on the subject. Six men can put up the dams and catch their fish in an hour; it is called in Burmese "kone tsin."

I was the spectator of a delightful scene yesterday which may interest some one; going up a rocky creek, up which no European had been and no one had shot for over 2½ years, and looking out for sambhur and other game, I came cautiously round a corner to see what at first sight seemed to be a sow with little pigs playing round her, but after a minute or two I saw that it was a buffalo lying down on the pebbles with a crowd of otters (I counted fifteen) literally gambolling over and round him. They leapt over his back, crouched like dogs at his nose, and generally baited him; at last he could stand it no longer, and got up and scattered the creatures, which all plunged into a pool, and after what looked like a brief water-polo match disappeared in some rocks. I watched this for about a quarter of hour, and only discovered myself on the departure of the otters. The buffalo was probably a stray one from one of the Kachin villages which dot the hills here and there.

D. H. M. BOYLE.

MANSI, 10*th April* 1909.

No. XXIII.—BRACHYMENIUM TURGIDUM, Broth, *n. sp.*

Among a small collection of mosses gathered by Mr. L. J. Sedgwick in Southern India, and communicated to me by Mr. G. B. Savery, was a *Brachymenium* very striking in the form and position of the capsules. Being unable to determine it, I sent it to Dr. Brotherus, who kindly examined it and replied that it was allied to, but specifically different from, *B. nepalense*, Hook., and he suggested for it the name *B. turgidum.* I append a description of it.

BRACHYMENIUM TURGIDUM, Broth., in lit.

Autoicum. Fl. masc. gemmiformes, in innovationibus apicules; anthendia pauca, 0, 4 mm. longa. Cœspites densi, laete virides vel rupescentes, subnitidi, 1-2 cm. alti, inferne sœpe tomentosi. Folia subæquales, *ad apicem caulis ramorumque haud rosulata,* humida et sicca *suberecta, haud patentia,* mollia, subflaccida, sicca contracta *nusquam spiriliter contorta,* ad 3 mm. longa, ovato-lanceolata vel late lingulato-lanceolata, *subintegra vel* integra, nervo fusco sat augusto (ad basin latiore) excedente integro cuspidata; cellulis leptodermicis elongato-hexagonis, pellucidis, 30-40μ longis, 10-15μ latis; limbo *perangusto,* e cellulis linearibus 2-3—seriatis composito. Folia perichœtalia rubra, parva triangularia, acuminata, inferne marginibus latiascule revolutis. Seta rufescens, 1, 5—2 cm., longa, *superne arcuata vel cygnea, theca ideo horizontulis vel pendula.*—Theca (cum collo) ad 3 mm. longa, *turgide ovalis vel late pyriformis,* collo breviusculo vix (nisi capsulis vetustis) defluente, microstoma; operculo hemisphœrico, obtuso, nitido. Annulus latus. Exothecii cellulœ pachydermicæ, valde irregulares. Exostomii dentes *pullidi,* basin versus lutei, 0·35—0·4 mm. alti; lamina dorsalis minute papillosa, linea media inferne distincte serpentina; lamellæ, laminœ ventralis *altissimœ,* 40-50μ *alti*; Endostium pallidum, inferne luteolum, 0·25 mm. altum, ubique dense minute papillosum; processus *sat longi,* ad 0·12 mm., alti, in crura bina divergentia obtusi fissi, ciliis nullis vel omnino rudimentariis. Spori magni, 35-45μ, minutissme granulati, virides.

Habitat.—On timber of a small bridge, Lonavli, W. Ghats, South India; alt. 2,000 ft.; Sep. 1907. L. J. Sedgwick. Also on branches of Cactus, Lonavli. Type in my herbarium.

A very distinct species, differing from most of the allied species of Brachymenium in the turgid, sub-pendulous capsule. From *B. nepalense,* Hook. it differs also in the leaves narrowly timbate and subentire, not at all spirally contorted when dry ; and the peristome also presents not unimportant differences. From most of the allied autoicous species of *Brachymenium* it is at once distinguishable either by the turgid sub-pendulous capsule, not narrow and sub-erect, or by the leaves not being twisted when dry, or by the extremely narrow entire border. *B. lanceolatum*, Hook. fil. and Wils, from Tasmania resembles it very closely in leaf characters, but the capsule is quite distinct. On the other hand, *B. glaucum* (C. M.) from Ceylon, to which it is probably most nearly related, has a turgid capsule, but according to the description (I have not been able to see a specimen) differs at once in having the leaves gathered into gemmiform rosulate tufts, very bright and shining, the perichætial leaves differing little from the cauline ones, the neck of the capsule longer (compared by C. Müller with that of *Leptobryum pyriforme*), and the structure of the peristome different.

The internal lamellæ of the peristome teeth in *B. turgidum* are very strikingly developed. I do not remember seeing them so high in any species of *Bryum* or indeed in any other moss.

H. N. DIXON.

(*From the* " *Reveu Bryologique* " (*pp.* 94-96), 1908.)

[Lt.-Col. K. R. Kirtikar adds the following note:—Mr. L. J. Sedgwick has kindly favoured me with a specimen of the moss which I propose to exhibit at the next meeting of the Society.—Eds.]

No. XXIV.—AN ACTIVE MUD VOLCANO.

Yesterday, when out shooting close to my camp, I discovered an active mud volcano. It is on a small hill about 150 ft. high and about two miles from the Irrawaddy river ; the volcano has three mouths, two about ten feet apart and the third about 150 ft. further to the west, all three are bubbling and throwing out a clayey oily mud which I suppose means that there is oil at the bottom of them. I could hear rumblings in the earth at a good depth. I shoved a bamboo down for some ten feet in one of the mouths.

Mud volcanoes of this description are common in the Minbu and Myingyan Districts of Upper Burma, and it is there that the famous petroleum oil wells of Burma are, and if oil is found there, why should it not be found here also ?

C. W. ALLAN.

HENZADA, BURMA, 4*th March* 1909.

REVIEW.

BIRDS OF THE PLAINS.

BY

DOUGLAS DEWAR.

Considering that so large a majority of the Members of the B. N. H. S. are what may be described as "casual" naturalists compared with those who lay claim to being scientific naturalists, any book that is intended to popularize the study of birds and other creatures around our lives in India is naturally of particular interest to us and especially when it is from the pen of one of our own members. The author of this book has latterly been a regular contributor to our columns and his present addition to the popular literature on Indian birds is practically a continuation of his previous volume that appeared under the somewhat weird title of " Bombay Ducks ". In his preface he confines himself to an expression of his views about titles of books generally, and to those of his own productions in particular, as his plumage would appear to have been a trifle ruffled by the comments which the title he selected for his previous book met with from most quarters. The title of the present volume is not quite so garish as the earlier one but can hardly be considered a great inspiration.

However it is the contents and not the title of the book that chiefly concern us and there is no denying there is a large amount of interesting writing in its pages on the author's and his friends' observances of the traits and characters of a number of familiar Indian birds.

Besides the interesting and instructive portions there is at times a large amount of padding which takes a good deal of wading through and which savours of the "penny a line" style of many of the articles that appear in Indian "Dailies." The book is evidently intended to appeal to the general public that takes a certain interest in the birds to be seen about the compounds of the bungalows and in the aviaries on the verandahs. Where cage-birds form the subject of the articles the notes are mainly confined, like the bird themselves, to the aviary although in many cases they relate to species that are common enough about most stations in the plains of India. It is of course easier to observe the habits of such birds from a long chair on a verandah than by crawling round hedgerows and bushes in the open. In the same way it is evidently from Zoological Gardens that the author has become familiar with other birds of which he writes. We cannot see what possible interest it can be to the general reader to be informed that "There is at present a Jackdaw in confinement in the Lahore 'Zoo.'" It may have interested a reader when it met his eye as he glanced over the morning paper at that station, but should surely, along with various other similar irrelevancies, have made the acquaintance of the editorial blue pencil when the article was intended for inclusion in such a book as this.

The doubt that is cast upon the well-recognised habit of the Shrikes of storing their captures impaled on the thorns of bushes is not exactly calculated to inspire one with the author's observances in the field, for even if he has never come across such a "larder", we and many others have done so, and it is a pity such previously undisputed evidence should be ridiculed. It is quite probable that some of the smaller shrikes have not the habit of "impaling their victims" in this manner but the remarks are generalized for the whole family.

We should have been much better pleased with the book if such articles as those on "The Stability of Species" and "Up-to-date-Species making" had been omitted as they are here completely out of place. The author essentially claims to be a field naturalist and plainly expresses his contempt of the museum worker. Much that is utterly foolish has been written and done by both sections of naturalists but it must always be borne in mind that all are striving within their own lights for the advancement of the same object and equally that neither section could make much real progress without the other.

The book is illustrated with reproductions of photographs taken by Captain Fayrer, I.M.S., some of which, that are evidently from specimens in confinement at Zoological Gardens, are quite excellent, but we must enter the strongest protest against these photographs being described as a whole on the title page as being "of living birds." Many of them are grotesque caricatures of the birds they are intended to represent and can only have been photographed from "stuffed" specimens such as we are accustomed to see in Indian Museums as the result of the efforts of native taxidermists to mount them.

OBITUARY.

E. H. AITKEN.

Eha has passed away. To numbers of the old members of our Society the news will bring sorrow and regret. The world is poorer by a good man and a genial spirit. He died of Bright's disease, never doubting to the last that he would soon be better. Nearly two years ago he retired to Edinburgh, having completed a long official service in this country. Some weeks before his death his sight failed, and he was never informed of the cause which, when discovered, had advanced to a stage that rendered recovery hopeless. He died on the night of Easter Sunday, the 11th April, at his residence in Morningside Place, Edinburgh. He suffered nothing and passed away peacefully in his sleep.

Edward Hamilton Aitken was born at Satara in the Bombay Presidency in the year 1851. He was the son of a Scotch Missionary. He was educated in Bombay and took the degree of B.A. and passed successfully the examination of M.A. in the Bombay University. He served first in the Educational Department, changed later into the Customs Department and rose to be Collector of Customs, Karachi, where the last two years of his time in India were passed. Having been brought up in this country, it was comparatively late in life that he went to England for the first time. The final change home, specially to a climate like that of Edinburgh in winter and spring, proved too severe for a man who had spent practically all his life in India, and there can be little doubt that it considerably hastened the end.

Eha was one of the original founders of our Society, he edited, in conjunction with others, the first numbers of our Journal and from that time forward to the end continued to contribute notes and articles to it. All branches of Zoology interested him, but more specially birds and insects, and for many years he was in charge of the Society's Entomological Section. Most of his spare time was spent in the study of animal life and he had a special genius for seizing the striking and characteristic points in the appearance and behaviour of individual species and a happy knack of translating them into print so as to render his descriptions unmistakeable. He looked upon all creatures in the proper way, as if each had a soul and character of its own. He loved them all and was unwilling to hurt any of them and accordingly was not a collector of specimens except in a very small way, just enough to get as thorough a knowledge as he judged sufficient of their lives and habits. But he kept many pets in his time, chiefly birds, which he was never tired of watching. Originally his attention was mainly confined to birds but he soon took up insects and was more particularly interested in butterflies. These last he had special opportunities of studying during some years' service passed in Kanara, the richest District in this respect of the Bombay Presidency, and he made ample use of his time there in investigating and writing about their life-histories.

He was a shrewd observer of humanity too as his book "Behind the Bungalow" testifies. This book is one of the Anglo-Indian classics and will remain a lasting monument to the memory of the author. His first literary venture was entitled "The Tribes on my Frontier," describing the animals ordinarily met with in and around an Indian bungalow. It is too widely known to require any remarks here. Another book of his is "The Common Birds of Bombay" which treats of the birds met with in the Town of Bombay and its vicinity in a manner that makes it easy for any one to recognise each individual when he sees it. "The Naturalist on the Prowl" written when he was in Kanara and full of the scent of the jungles is perhaps less generally known than those already mentioned. He made next to nothing by the sale of his two first books, large though it must have been. All his books are well known in India as they well deserve to be, for they are full of accurate knowledge pleasantly imparted, a quaint humour which cannot but appeal to the reader and the joyousness of living which expresses so well the nature of the writer.

He was a good man in every sense of the word, a strongly religious man, a pleasant companion, broad minded, exceedingly tolerant of the weaknesses of others, gentle and loveable and a rare example of a man without a single enemy. At home in Scotland he had looked forward to many years of leisure in which to write down the result of his life's observations in natural history, and it is to be regretted that the time was not granted him in which to add to the debt of gratitude we owe him for the books he has left behind. It may be of interest to those who knew him to learn that his funeral was attended by no fewer than five members of the Society. They were Dr. D. Macdonald, J. Davidson, I.C.S., retired, Lt.-Col. W. B. Bannerman, Major G. Lamb and Major C. J. Robertson-Milne.

T. R. B.

Mr. Aitken's Connection with the Society.

As Mr. Aitken was one of the oldest Members of the Society it may be interesting to refer to the early History of the Society and his connection with it.

The Bombay Natural History Society, which has now over 1,400 Members stationed in all parts of India and Burma and also at home, owes its inception to seven men of whom Mr. Aitken was one, and it was at their first Meeting that Mr. Aitken seconded the proposition that the new Society should be called "The Bombay Natural History Society." This Meeting was held on the 15th September 1883 at the Victoria and Albert Museum in the Victoria Gardens, Bombay, where until February 1884 the regular Meetings of the Members were held. Mr. Aitken was the first Honorary Secretary of the Society and continued as such until his departure from Bombay in March 1886.

The early Members of the Society were all keen naturalists who contributed to make the Meetings both interesting and instructive, and as many as forty Members were often present at the early Meetings. In consequence the want of a more central meeting place and rooms where the collections of Members could be kept, was soon felt, and early in 1884 the collections of the Society were moved to rooms in Forbes Street placed at the Members' disposal by Mr. H. M. Phipson and here the Meetings of the Members were held and the work of the Society carried on until December 1885 when the Society moved into their present quarters.

With the growth of the Society the need of a Journal was soon felt—a publication in which whatever was of value or interest transacted at the Meetings could be permanently put on record. The first Editors were the late Mr. R. H. Sterndale, whose works on Indian Zoology are well known, and Mr. E. H. Aitken. The first number was produced in January 1886.

In introducing the first number of the Journal the Editors expressed the hope that "The introduction of this Journal will stimulate lovers of Nature to record and communicate their observations." This hope has been realised and the papers published in the Journal since its commencement have borne splendid testimony to the debt owed by Naturalists in India to Messrs. Aitken and Sterndale.

Mr. Aitken was Honorary Secretary of the Insect Section from its commencement until the death of Mr. DeNicéville when he became President of the Section. He was elected a Vice-President of the Society in July 1902 and occupied this position until his retirement from India.

CORRESPONDENCE.

The following letter addressed to the Editors of the Journal has been received:—

Sir,—It is high time that Naturalists and Ornithologists in India bestirred themselves to obtain real protection for birds in the breeding season.

Birds in this country are being increasingly persecuted and their numbers lessened by the operations of unscrupulous egg collectors.

Whether true Nature Study is on the increase in India I very much doubt, but there is no doubt that egg collecting and of the most unscientific kind (on the get rich quickly principle) is becoming more and more popular and excites a nefarious competition in some of our hill stations. Gangs of coolis and so-called shikaris are employed to take all and every egg they come across and the taking of eggs is even left to be carried on by these men when the collectors themselves are away in the plains. Such examples are contagious, and every grass cutter and wood cutter endeavours to supplement his monthly pay by bringing into the station for " bakshish " every egg he can lay hands on.

Season after season the birds are harried in this way and the result is not hard to imagine.

In one hill station I know species have been appreciably lessened within the last few years, and the charm of its scenery has, in my opinion, suffered considerably in consequence. Legitimate collecting for scientific purposes and by the true Naturalist and Oologist who is himself generally solicitous for the preservation of and a lover of bird-life is not in question. But the increase of amateur egg collecting in this country is assuming most undesirable proportions and the time has certainly come for legislation to put a stop to it.

H. A. F. MAGRATH, Major.

26th May 1909.

[We cordially support Major Magrath's appeal and hope that Members of the Society will do all in their power to hinder the "mere egg collector." It would be well if egg collectors would realize that an egg, unidentified by a competent person, is worthless from a naturalist point of view. Where the pleasure of collecting eggs brought in by natives for sale comes in we fail to see. To the true Naturalist the whole pleasure of egg collecting is not the amassing of huge series of eggs but the taking of specimens after carefully identifying the parent bird. The late Professor Newton, who had a passion for egg collecting, in his "Suggestions for forming Collections of Bird's eggs" remarks "The collecting of bird's eggs for scientific purposes requires far more discrimination than the collecting of specimens in almost any other branch of Natural History. While the Botanist, and generally speaking the Zoologist, at home is satisfied as long, as he receives the specimens in good condition with labels attached giving a few concise particulars of when and where they were obtained it should always be borne in mind that to the Oologist such facts, and even the specimens themselves, are of very slight value unless accompanied by a statement of other circumstances which will carry conviction that the species to which the eggs belong has been accurately identified, and the specimens subsequently carefully authenticated. Consequently precision in the identification of his specimens should be the principal object of an egg-collector, to attain which all others must give way. There are perhaps few districts in the world, and certainly no regions of any extent, whose faunas are so well-known that the most rigid identification may be dispensed with."—Eds.]

PROCEEDINGS

OF THE MEETING HELD ON THE 18TH OF MARCH 1909.

A Meeting of the Members took place at the Society's Rooms on the 18th March when Mr. James MacDonald presided.

NEW MEMBERS.

Mr. W. Ward (Ootacamund); Mr. A. K. Graham (Bombay); the Mess President, 6th Light Infantry (Jhansi): Mr. M. M. L. Currie, I.C.S. (Rajanpur); Mr. R. S. Garrett (Ajmere); Mr. H. E. W. Martindell (Shwebo); Lt.-Colonel F. FitzGibbon, R.A. (Jubbulpore): H. H. Bijaya Singhji, Bahadur (Dungarpur); the Mess Secretary, R.I.M.S. "Dufferin" (Bombay Harbour); Mr. L. Sreenivasaraghaya Aiyer (Ranipettai); Capt. C. E. Palmer, I.M.S. (Kohat); Mr. D. Macintyre (Chitral); Mr. L. J. Sedgwick, I C.S. (Thana); Mr. S. C. Clayton (Satara); Mr. G. F. Paddison, I.C.S. (Berhampore); Mr. R. T. Foster (Bangalore); Rev. Thomas Rowan (Panchgani); Sirdar Anandrao Scindia (Gwalior); Mr. R. S. Skinner (Bilaspur); Mr. C. T Mullins (Guntur); Dr. Armstrong Smith (Bombay); Mr. H W. Waite (Ferozepore); Capt. G. W. Hemans (Bolarum); Lt. P. D. C. Johnston (Dilkusha); Mr. Oscar Kauffmann (Marburg, Germany); Major T. W. Irvine, I.M.S. (Udaipur); Major Richard Heard, I.M.S. (Lyallpur); Capt. S. S. Flower (Ghiza, Egypt); Dr. C. A. Bentley, M. B., D. Ph (Calcutta); Mr R. D. Dickie (Padouk); Mr. H. H. Gallie (Padouk); Mr. W. H. Lucas, I.C.S. (Karachi); Sir Tatton Sykes (York, England); Mr. S. Prem Narian Pandit (Jaipur); Capt. J. J. Unwin, M. B. (Motihari).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged the following contributions to the Museum :—

LIST OF CONTRIBUTIONS.

Contribution.	Locality.	Contributor.
Skin of an Indian Lion (*Felis leo*)............	Gir Forest, Kathiawar.	H. H. Nawab of Junagadh.
2 Jackal Skins (*Canis aureus*)....	Mahommerah	Lt. A. F. Wilson.
2 Fox Skins (*Vulpes sp.*)..........	Do.	Do.
Head of Himalayan Thar (*Hemitragus jemlaicus*).	Almora	Through Major F. Wall, I.M.S.
Head of Goral (*Cemas goral*)	Do.	Do.
Head of Serow (*Nemorhadus bubalinus*)......	Do.	Do.
1,600 Bird skins....................................	....	Major H. J. Walton, I.M.S.
1 Indian House Crow (*Corvus splendens*) variety.	Jullundur	L. C. Glascock.
Punjab Red-vented Bulbul (*Molpastes intermedius*).	Jhelum	Capt. A. Delmé Radcliffe.
Hume's White-eared Bulbul (*Molpastes humei.*)	Do.	Do.

Contribution.	Locality.	Contributor.
Himalayan Whistling Thrush (*Myiophoneus temmincki*).	Jhelum	Capt. A. Delmé Radcliffe.
Scully's Wood Owl (*Syrnium biddulphi*)	Dunga galli	Capt. J. Lindsay Smith.
Mrs. Hume's Pheasant (*Phasianus humiæ*).	Haka, Chin Hills, Burma.	F. Venning.
2 Red Spur Fowls (*Galloperdix spadicea*)	Kheri District	A. R. Wood.
1 Lapwing (*Vanellus vulgaris*)	Bengal	C. M. Inglis.
Common Coot (White variety) (*Fulica atra*).	Thar and Parkar Dist., Sind.	M. D. Mackenzie.
Common snipe (variety) (*Gallinago cælestis*).	Pithro, Sind	W. Z. Nicholas.
Solitary Snipe (*Gallinago Solitaria*)		
Large Cormorant (*Phalacrocorax carbo*)	Jhelum	Capt. A. Delmé Radcliffe.
1 Gull (immature) (*Larus sp.*)	Mimber, Burma	G. H. Stewart.
2 Shovellers (*Spatula clypeata*)	Kharagodha	S. H. Prater.
Pinkheaded Duck (*Rhodonessa caryophyllacea*).	Singu, Upper Burma.	E. R. Jardine.
Pintail (*Dafila acuta*) ♀	Dinapore	F. M. Luce, I.C.S.
White-winged Wood Duck (*Asarcornis scutulatus.*)	Tenasserim	K. C. Macdonald.
Teal (*Nettium crecca*)	Haka, Chin Hills, Burma.	F. Venning.
Baikal Teal (*Nettium formosum*)	Lyallpur	Capt. J. Lindsay Smith.
10 Lizards	Srinagar	F. Mitchell.
5 Frogs	Do.	Do.
Several Chameleons	Thana Dist.	C. E. L. Gilbert.
2 Snakes (*Lycodon aulicus* and *Macropisthodon plumbicolor.*)	Satara	Capt. A. Delmé Radcliffe.
1 Snake (*Dendrophis pictus.*)	Umaria	W. S. Killing.
1 Cobra (*Naia bungarus*)	Bombay	H. B. Saxby.
1 False Himalayan Viper (*Psamodynastes pulveralentus.*)	Upper Burma	D. H. Boyle.
3 Snakes (*Psammophis longifrons*)	Sudra	Capt. E. O'Brien.
2 Snakes (*Amblycephalus moellendorffi*)	Siam	B. A. Boxhill.
2 Sea Snakes	Bushire	H. M. S. Lapwing.
Several Fish (*Labeo sp.*, *Oreinus sp.*, *Schizothorax sp.*, *Exostoma stoliczkæ*, and *Botia geto*, etc.)	Srinagar	F. Mitchell.
106 Beetles of 51 species	Various	H. M. Lefroy.
A number of Shells	Bengal	Dr. W. Forsyth.
One Crab	Bay of Bengal	Do.
A Collection of Butterflies	Chanda, C. P.	D. O. Witt, I.F.S.

Minor contributions from Messrs. A. Montgomerie, A. Kirke Smith, Berriman Vears, and Major H. A. Magrath.

EXHIBITS.

KATHIAWAR LION.

The attention of members was drawn to the skin of a fine Kathiawar lion which was exhibited and which had been obtained for the Society through the generosity of H. H. The Nawab of Junagadh and through the instrumentality of two of the Society's members, Mr. C. H. Hill, I.C.S., and Mr. W. H. Lucas, I.C.S. The lion was shot by Mr. Dudley Myers. The skin is being sent to England for mounting.

The Honorary Secretary exhibited some West Indian Bananas "*Musa cavendishii*" which he had grown in Bombay, and members present were requested to try them and report whether they preferred them or not to the local varieties of plantain. He mentioned that 126 fruits were on the first bunch.

The collection of snakes which had been mounted by Mr. Kinnear for the Medical Congress was exhibited and greatly admired.

ACCOUNTS FOR 1908.

The Honorary Treasurer, Mr. L. H. Savile, presented the statement of accounts for 1908, which he observed, showed a satisfactory result. The subscriptions for the year were Rs. 17,094-13-3 showing an increase of Rs. 1,822-7-2 over the previous year. The entrance fees were Rs. 1,480 compared with Rs. 1,440 for 1907, and 160 new members had been elected during 1908 against 157 in 1907.

The accounts having been audited and found correct were duly passed.

ELECTION OF THE COMMITTEE.

The following gentlemen were elected as office bearers for the present year :—

President :—H. E. Sir George Clarke, F.R.S., G.C.I.E.

Vice-Presidents :—Revd. F. Dreckmann, S.J., Mr. J. D. Inverarity, B.A. LL.B., and the Hon'ble Mr. Justice N. C. Macleod.

Managing Committee:—Vety.-Col. G. H. Evans ; Mr. E. C. Stuart Baker, F.Z.S. ; Mr. E. Comber, F.Z.S. ; Mr. E. E. Green, F.E.S. : Professor G. A. Gammie ; Mr. T. R. Bell, I.F.S. ; Col. W. B. Bannermann, I.M.S. ; Mr. H. Bulkley ; Mr. C. L. Burns ; Rev. E. Blatter, S. J. ; Major G. Lamb, I.M.S. ; Capt. W. Glen Liston, I.M.S. : Mr. H. Macnaghten Mr. H. Maxwell Lefroy ; Mr. J. McNeill, I.C.S. ; Lt.-Col. A. Newnham ; Mr. N. B. Kinnear ; Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.) ; Mr. G. M. Ryan, I.F.S. ; Major F. Wall, I.M.S., C.M.Z.S. ; and Mr. J. Wallace, C.E.

Honorary Librarian :—Mr. B. D. Richards, B. Sc.

Honorary Treasurer :—Mr. L. H. Savile (*ex-officio.*)

Honorary Secretary :—Mr. W. S. Millard (*ex-officio.*)

THE JOURNAL.

The Secretary announced that the Index Number (No. 5, Vol. XVIII) of the Society's Journal had just been published and as No. 1, Vol. XIX., would be ready in a few weeks the two numbers would be posted together to up-country members.

PAPER READ.

The following paper was then read :—

The History of the Sea Cocoanut (Lodoicea Sechellarum) by Rev. E. Blatter, S.J.

PROCEEDINGS

OF THE MEETING HELD ON 24TH JULY 1909.

A Meeting of the Members of the Bombay Natural History Society took place at the Society's Rooms on Thursday evening, the 24th July 1909, the Revd. F. Dreckmann, S.J., presiding.

The election of the following 91 new members since the last meeting was announced :—

Mr. B. Sen Gupta (Gairkatta) ; Capt. H. LeM. Fellows, 47th Sikhs (Rawal Pindi) ; Mr. William Burns (Poona) ; Mr. C. G. Leftwich, I.C.S. (Khandwa); Mr. Lane Brown (Benares); Mr. R. F. Greer (Thaton); Mr. R. G. T. Gatherer, 10th Gurkhas (Bhamo) ; The Mess Secy., 64th Pioneers (Belgaum) ; Lt. R. F. Francis, 47th Sikhs (Dera Ismail Khan); Mr. J. D. Bharda (Bombay) ; Mr. E. W. Fritchley (Bombay); Lt.-Col. A. C. Younan, I.M.S., 25th Punjabis (Rawal Pindi); Mr. L. W. Middelton (Sonapore) ; The Hony. Secy., Royal Asiatic Society (Bombay); Mr. L. A. Luffman (Bamrup); Mr. G. S. Henderson (Mirpur Khas) ; Mr. D. R. H. Browne (Mirpur Khas); Mr. G. R. Bhatia (Gonda) ; Mr. P. E. Plunkett (Katha) ; Col. D. O'Sullivan (Quetta) ; Mr. A. A. Flynn (Bostan, Baluchistan) : The Mess Secy , 39th C. I. Horse (Goona) ; Capt. F. R. S. Gervers (Cawnpore) ; Mr. P. C. Briscoe (Rahatungoda) ; Mess President, 103rd M. L. Infy. (Belgaum) ; The Curator and Librarian, Vict. Tech. Inst. (Nagpur) ; Mr. H. E. H. Johnston-Stewart, Highland Lt. Infy. (Dilkhusha) ; The Hony. Secy., The Book Club, 67th Punjabis (Multan Cantt.); Mr. A. G. Frere (Tharrawady) ; Mr. A. J. Russell (Mansi ; Mr. J. Oliphant (Mansi) ; Mr. Martin Hallauer (Bombay) ; Mr. W. P. Cowie (Ahmednagar) ; Rear-Admiral E. J. Warre Slade (Bombay) ; Mr. R. E. A. Elliot, I.C.S. (Bombay) ; Mr. W. Graham (Bombay) ; Mr. J. H. Skelton (Bombay) ; Mr. R. G. Campbell (Bombay); Mr. C. H. H. Chessall (Bombay) ; Mr. T. E. Durie (Bangalore) ; Mr. H. J. Dunlop (Secunderabad) ; Major L. E. O'Connor, C.I.E. (Quetta) ; Dr. H. T. Holland (Quetta) ; Mr. A. Anderson (Quetta) ; Mr. Lala Mulraj (Quetta) ; Mr. T. Clear (Madras); Lt.-Col. J. R. Roberts (Indore) , Capt. A. C. Wardrop, R.H.A. (Mhow) ; Mr. John N. List (Henzada) ; Capt. M. R. K. Hodgson, Royal Fusiliers (Trimulgherry) ; Sir B. S. Brooke, Bart. (Trimulgherry) ; Dr. J. Dunlop (Parkola) ; Capt. J. Martin, 94th Russell's Infy. (Baroda) ; H. H. Iftikhar Alikhan (Jaora) ; Miss Birrell (Simla) ; Hony. Secy., United Service Club (Bangalore); Mr. R. G. M. Johnston, R.H.A. (Bangalore); Mr. C. H. James (Lahore) ; Mr. J. Coldstream, I.C.S. (Simla) ; Mr. J. Gray, 36th Sikhs (Rawal Pindi) ; Capt. W. C. Long, I.M.S. (Madras) ; Mr. H. A. Goldsmith, 95th Russell's Infy. (Bolarum) ; Mr. E. A. Hughes (Travancore) ; Mr. A. J. Wright (Travancore) ; Mr. W. G. Dawson, (London) ; Mr. H. R. C. Dobbs, I.C.S., C.I.E. (Quetta) ; Captain Terence Keyes (Quetta) ; Mr. L. H. Kirkness (Madras) ; Mr. W. R. Gibson (Madras) ; Mr. J. E. M. Boyd, R.A.M.C. (Ferozepore) ; Mr. A. A. Porter (Siam) ; Mr. C. T. Graham (Rangoon) ; Mr. C. Clifford Batten (Mussoorie) ; Mr. G. W. Giles (Madras) ; Mr. J. Erskine (Kotagiri); Mr. A. Butcher (Behalli P. O.); Major John H. Whitehead, 93rd Burma Infty. (Mandalay); Mr. A. McKenel, M. A., B. Sc. (Mandalay); Mr. G. C. Tew, I.C.S. (Mandalay); Mr. Edwin W. Hill (Mandalay); Mr. A. Kenyon Rogers (Barrackpore); Mr. T. Carr (Naini Tal); Mr. L. A. Thruston (Mandalay); Mr. S. P. Limaye (Satara); Mr. E. H. A. Goss (Shwebo); Mr. K. McDiarmid (Shwebo); Mr. C. R White (Shwebo); Capt. E. C. C. Maunsell, I.M.S. (Baroda); Mr. D. J. Montagnon (Chandkira); Mr. A. H. M. Barrington (Rangoon); and Mr. C. G. E. Dawkins, I.F.S. (Pyinmana).

CONTRIBUTIONS TO THE MUSEUM.

The Joint Honorary Secretaries acknowledged the following contributions to the museum:—

Contribution.	Locality.	Contributor.
Himalayan Langur (*Semnopithecus schistaceus*).	Tibet	Lt. F. M. Bailey.
Muntjac (*Cervulus muntjac* ♀)	Dhulia	A. J. Montgomery.
2 Burmese Squirrels	Burma	Major A. Mears.
2 Eggs of the White-eyed Buzzard Eagle (*Butastur teesa*).	Satara	Capt. A. Delmé Radcliffe.
1 Indo-Burmese Hornbill (*Anthracoceros albirostris*).	Burma	Major A. Mears.
4 Eggs of the White-bellied Drongo (*Dicrurus cœrulescens*).	Bellary	P. R Allen.
1 European Striated Swallow (*Hirundo rufula*).	Quetta.....................	Baluchistan Nat Hist. Soc.
Biddulph's Ground Chough (*Podoces biddulphi*).	Turkestan	Col. J. A. Betham.
3 Eggs of large Pintailed Sandgrouse (*Pterocluras alchata*).	Muhammarah	Lt. A. T. Wilson.
Barn Owl (*Strix flammea*)	H. M. Mint, Bombay	J. P. Guidera.
31 Bird Skins	Shillong & Kashmir	E. C. Stuart Baker.
Snake (*Coluber porphyraceous*)	Sadeon, Burma ...	T. G Wilson.
Several *Tropidonotus stolatus*	Madras	H. M. Dwane.
1 Earth Snake (*Eryx jaculus*)	Muhammarah	Lt. A. T. Wilson.
1 Snake (*Psammophis condinarus*)... ...	Mussooree	P. Mackinnon.
1 Common Krait (*Bungarus cœruleus*) and *Dendrelaphis tristis*.	Madras	H. M. Dwane.
1 Cobra (*Nia tripudians*), black variety ...	Jhansi	Lt. C. Thornhill.
1 Common Wolf Snake (*Lycodon aulicus*)	Khandeish	S. D. Smith, I.C.S.
1 Green, Keelback (*Macrophisthodon plumbicolor*).		
1 Phoorsa or Kuppa (*Echis carinata*)		
1 Chequered Water Snake (*Tropidonotus piscator.*)		
1 *Oligodon subgreseus*...		
A small collection of snakes including *Bungarus niger*, *Ablabes rupii*, *Tracheschium gunthori*, *Callophis macclellandi*, etc.	Darjeeling & Assam	Major F. Wall, I.M.S
Several Butterflies	Naini Tal	F. Hannyngton.
30 Specimens of Hemiptera	Ceylon	E. E. Green.
82 Specimens of Hymenoptera	Pusa, etc.	H. M. Lefroy.
A number of Beetles	Simla	Lt. H. G. Cluppendale.
Do. do.	Rangoon	R. G. Fagan.
Do. do.	Assam............	L. W. Middelton.

Minor Contributions from—E. W. Fritchley, Simpkins, J. A. Betham, W. W. Coen, Capt. Thomson, Capt. A. R. Yule, P. Gerhardt, H. Blair, H. M. Dwane, Lt. A. M. Lloyd, Lt. R. Francis, F. V. Gokhale, D. M. Bayle.

THE LATE Mr. AITKEN.

The Chairman, the Rev. F. Drekmann, said: Before we proceed with the business of the meeting I wish to move that on behalf of the members of the Bombay Natural History Society, the Honorary Secretaries be instructed to express to the widow and family of Mr. E. H Aitken their condolence with them in their sorrow and their sense of the great loss the Society has experienced through Mr. Aitken's death. He then briefy referred to the great services rendered to the Society by Mr. Aitken since its inception.

The proposition was seconded by Mr. William Bell and carried unanimously.

PAPERS READ.

The following papers, both of which will appear in full in the Society's Journal, were then read and discussed :—

Some Nature Notes, by Lt. Col. R. G. Burton.

The Nesting Habits of the Baya or Weaver Bird, by Douglas Dewar, I.C.S.

A vote of thanks having been passed to the authors of the different papers the Meeting terminated.

BALUCHISTAN NATURAL HISTORY SOCIETY.

PROCEEDINGS OF A MEETING OF THE MEMBERS HELD IN THE QUETTA MUSEUM AND LIBRARY BUILDING ON THURSDAY, 25TH MARCH 1909.

Read letter No. 317, dated 13th March 1909, from Dr. Annandale, Superintendent, Indian Museum, stating that he had forwarded the Quetta Isopod sent to him on 27th May 1908, to Reverend T. R. Stebbing, England, the great authority on the group.

The Hon'ble President impressed upon all present the necessity for collecting everything they come across and remarked that the commonest animals were often the very last to be identified.

Read letter, dated 20th March 1909, from Mr. E. J. Gleeson, advising despatch of a White or Roseate Pelican, and stating that immense flocks of this bird pass over Upper Zhob on migration and that the natives shoot or otherwise capture the bird for its oil which they value highly for its medicinal properties.

A copy of "A Working List of the Flowering Plants of Baluchistan" prepared by Mr. I. H. Burkill of the Indian Museum, Calcutta, was then placed before the Meeting by the Honorary Secretary.

The Hon'ble President commented on the importance of the List and urged upon Members to do their best to add to it.

A specimen of rock "Shah Bilawal" in Las Bela was next passed round, Mr. Dracott remarking that it was known locally as "Zahira Mera" and was used medicinally by the natives for snake bites and also as charms.

In conclusion, the Hon'ble President invited such of the members as had not already done so to join the Bombay Natural History Society and invited particular attention being paid to Crabs, it being yet not known to Science how the young are produced, *i. e.*, whether hatched from eggs or otherwise brought into being.

The following gave in their names as desirous of joining the Bombay Natural History Society:—

Col. D. O'Sullivan and Mr. A. A. Flynn.

PROCEEDINGS OF A MEETING OF THE MEMBERS HELD IN THE QUETTA MUSEUM AND LIBRARY BUILDING ON THURSDAY, THE 29TH APRIL 1909.

Members who had not already done so were then invited to join the Bombay Natural History Society, and the following gave in their names:—

Major L. F. O'Connor, C.I.E.
Doctor H. T. Holland.
Mr. A. Anderson and Lala Mulraj.

The Hon'ble President then closed the proceedings with a few remarks. He expressed great pleasure at the large attendance at this Meeting, congratulated the Society on the value and beauty of many of the specimens collected during the past month, thanked the Members for their donations, expressed himself as very pleased at the interest taken in collecting by the rising generation and especially thanked Mr. Flynn for the trouble and care taken and success attained by him in mounting the specimens presented by him. He also mentioned that the Honorary Secretary was anxious to start separate albums of paintings of (1) the Birds, (2) the Butterflies and Moths, and (3) the Wild Flowers of Baluchistan, which he thought an excellent idea. He considered that the first contribution made by Miss Butler towards this end a most useful one and beautifully executed, and expressed the hope that others who were able would kindly come forward and assist in a similar way, anything in the way of paintings and drawings being of great value, especially paintings of birds, as the colour of the beaks and legs of preserved specimens fade so very quickly.

The Hon'ble President also mentioned that he had heard that Mr. Chibbir, Assistant Professor of Botany, Agricultural College, Poona, had, unknown to him, visited Quetta and taken away a large collection of wild flowers, of which he proposed to present a set to the Quetta Museum, and expressed the hope that Members interested in the subject would assist in the Botanical collection. In conclusion, the Hon'ble President congratulated the Society on the fact that Mrs. Dobbs had shown her interest in the Society by not only gracing the Meeting with her presence but by consenting to become a Member.

PROCEEDINGS OF A MEETING OF THE MEMBERS HELD IN THE QUETTA MUSEUM AND LIBRARY BUILDING ON THURSDAY, THE 27TH MAY 1909.

A list of the Donations made to the Museum since the last Meeting was then read out, the exhibits themselves being passed round for inspection. Of these the more important were :—

A Persian Nightingale from Quetta, presented by Master Walter Cumming.

A Red-necked Phalarope from Quetta, presented by Master Arthur Cumming.

Two Mottled Pole Cats from Quetta, presented by K.S.A.D. Marker.

A beautiful little Dormouse from Quetta, presented by Master P. Stranack.

A fine Lizard. (*Varanus griseus*) from Quetta, presented by Pratap Singh Sethi.

A rare Bug (*Pyrrhocoris apterus*) from Quetta presented by Mr. A. A. Flynn.

The Persian Nightingale and the Dormouse, which are the first specimens known to have been procured in Quetta, attracted especial attention on account of their rarity.

Paintings of the Indian Blue-throat (2), European Bee-Eater (2), and Persian Nightingale (1), by Major T. H. Goodwin, R.A.M.C., and one of the Common Wryneck by Mr. A. D. McDonough were also passed round, the Hon'ble President thanking both Major Goodwin and Mr. McDonough for their very valuable donations to the Museum Albums.

A large number of valuable Zoological and other Scientific Journals, kindly presented to the Museum by the Hon'ble Sir Henry McMahon, were also placed on the table for the information of Members.

The Hon'ble President then enquired if any of the new members wished to join the Bombay Natural History Society, and Mr. H. R. C. Dobbs, I.C.S., C.I.E., and Capt. Terence Keyes, I.A., gave in their names.

There being no further business the Hon'ble Sir Henry McMahon reminded all present that the 10th instant made just two years since the Society was established and congratulated the Members on the good work done during that brief period. He remarked that zoological and other specimens had come in so rapidly that the Museum was already full and that proposals were being sent in for trebling the present accommodation. The Hon'ble President here circulated the plans of the proposed extensions and expressed the hope that the Revenue Commissioner would be able to find the necessary funds as the additions were necessary both on scientific and public grounds—on scientific grounds because Baluchistan by its geographical position held an important place in the Fauna World, as it is visited by numerous birds of passage from Europe and India and produces among its own permanent fauna most interesting animals like the Mottled Pole Cat, Euphratic Viper, etc., which have been found nowhere else except in what is known as the Mediterranean area. The object of the Museum, he said, was to make an exhaustive and representative collection of the Fauna and Flora of Baluchistan, which could be examined and studied later on by experts when the necessary funds were forthcoming.

The proposed extensions were also necessary on public grounds because the general public who frequented the Central Hall, now used jointly as a Reading and Museum Room, complained of being inconvenienced by the stream of visitors to the Museum.

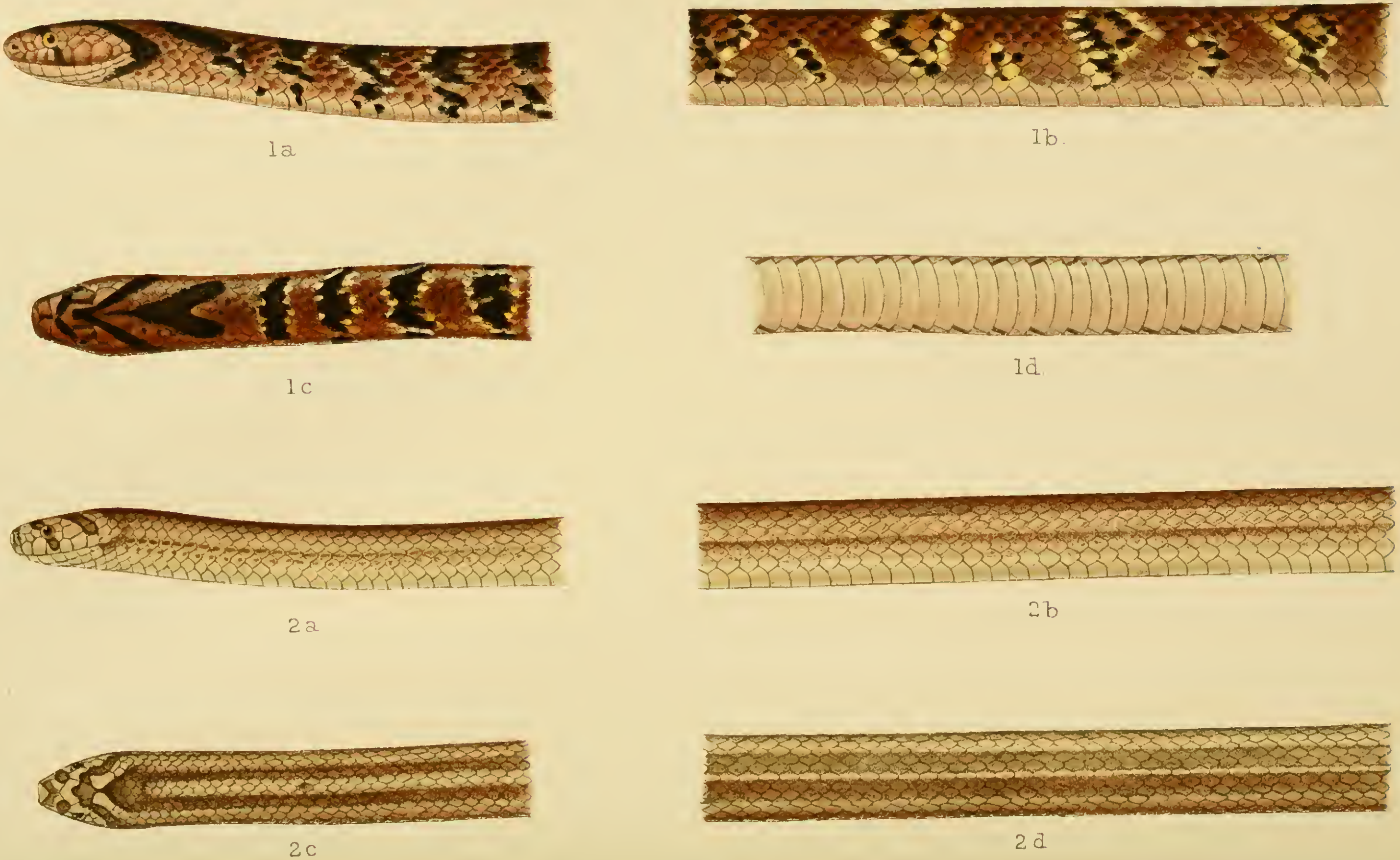
The Hon'ble President next read a notice issued by the Director of The Hungarian Central Bureau for Ornithology, Budapest, regarding the marking of young birds of passage with aluminium rings fastened round their legs, which bear in each case the inscription "Budapest" followed by a number corresponding to the entry in the Register book of the Hungarian Central Bureau for Ornithology, and requesting any one catching such a marked bird or hearing of the capture of such, to forward the ring with particulars as to locality, time and particulars of capture, to the Bureau in question. He hoped that any one making such a find would promptly comply with the request of the Bureau.

In conclusion, Sir Henry mentioned that he was proceeding on the 2nd June to England on short leave. He requested the Vice-Presidents to take charge of the Society during his absence and expressed the hope that Members would do all in their power to add to the collections in the Museum, especially as regards obtaining further specimens of Dormice.

There being no further business, the meeting adjourned.

124

Plate XI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THE COMMON INDIAN SNAKES. (Wall).
Oligodon subgriseus, *harmless. nat. size*

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XIX. BOMBAY. No. 3.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part XI with Plate XI and Diagram and Map.

(Continued from page 299 of this Volume.)

The genus *Oligodon* as regarded by Mr. Boulenger in 1894[*] comprised 18 species, 17 of which were known to inhabit Southern Asia from Baluchistan in the West to the Philippines in the East; the one exception being an Egyptian snake. Since this date Mr. Boulenger has described two new species, *viz.*, *erythrogaster* from Nepal,[†] and *herberti* from Mogok in Upper Burma,[‡] and given his authority for the inclusion in this genus of the Andaman snake *woodmasoni*[§] which he had previously regarded as a *Simotes*.

I have also added three new species, *viz.*, *mcdougalli*[¶] from Sandoway, Burma, *melaneus*[||] from Tindharia in the Eastern Himalayas and *erythrorhachis* from Nanwang, Assam, the description of which will appear shortly in this journal. The genus therefore as now constructed includes 24 species. It is very closely allied to the genus *Simotes*, in fact it remains to be seen whether there is a natural division between the two genera, and if so again whether some of the species as now arranged have not been intermixed.[*]

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[*] Catalogue, Vol. II, p. 233.

[†] Records, Ind. Mus., Vol. I, Part. III, 1907.

[‡] Bomb. Nat. Hist. Journl., XVI, p. 235.

[§] Annandale. J. A. S., Bengal, 1905, p. 173.

[¶] Bomb. Nat. Hist. Journl., XVI, p. 251.

[||] Bomb. Nat. Hist. Journl., Vol. XIX., p. 349.

THE VARIEGATED KUKRI SNAKE.

OLIGODON SUBGRISEUS (Duméril et Bibron).

History.—There is little if any doubt but that the earliest specimen of *subgriseus* of which we have any record is that collected at Vizagapatam and figured by Russell[†] 113 years ago, under the vernacular name "wanapa pam," scientific nomenclature in those days not having come into use. It is possible too that the snake from Canara alluded to by Jerdon as *Xenodon dubium* in 1853[‡] was this species, as he says the scales were in 15 rows, but he gives no description of it so that his name has been ignored. I cannot however see cause for dismissing the name *tæniolata*[§] applied by the same author to this snake in 1853 in favour of Duméril and Bibron's name *subgriseus* in 1854.[¶]

Nomenclature. (*a*) *Scientific.*—The generic name (from the Greek ὀλίγος few, and οδους tooth) was given by Boie to a Javan snake (*O. bitorquatus*) in 1827 on account of the paucity of its teeth compared with other ophidians. The specific title is from the Latin "sub" beneath, and "griseus" grey, the original specimen being this hue on the belly, a circumstance due, I think, to the preservative since it is white in life.

English. (*b*)—The Variegated Kukri Snake. The name kukri snake suggests itself to me as appropriate to the species of the genera *Oligodon*

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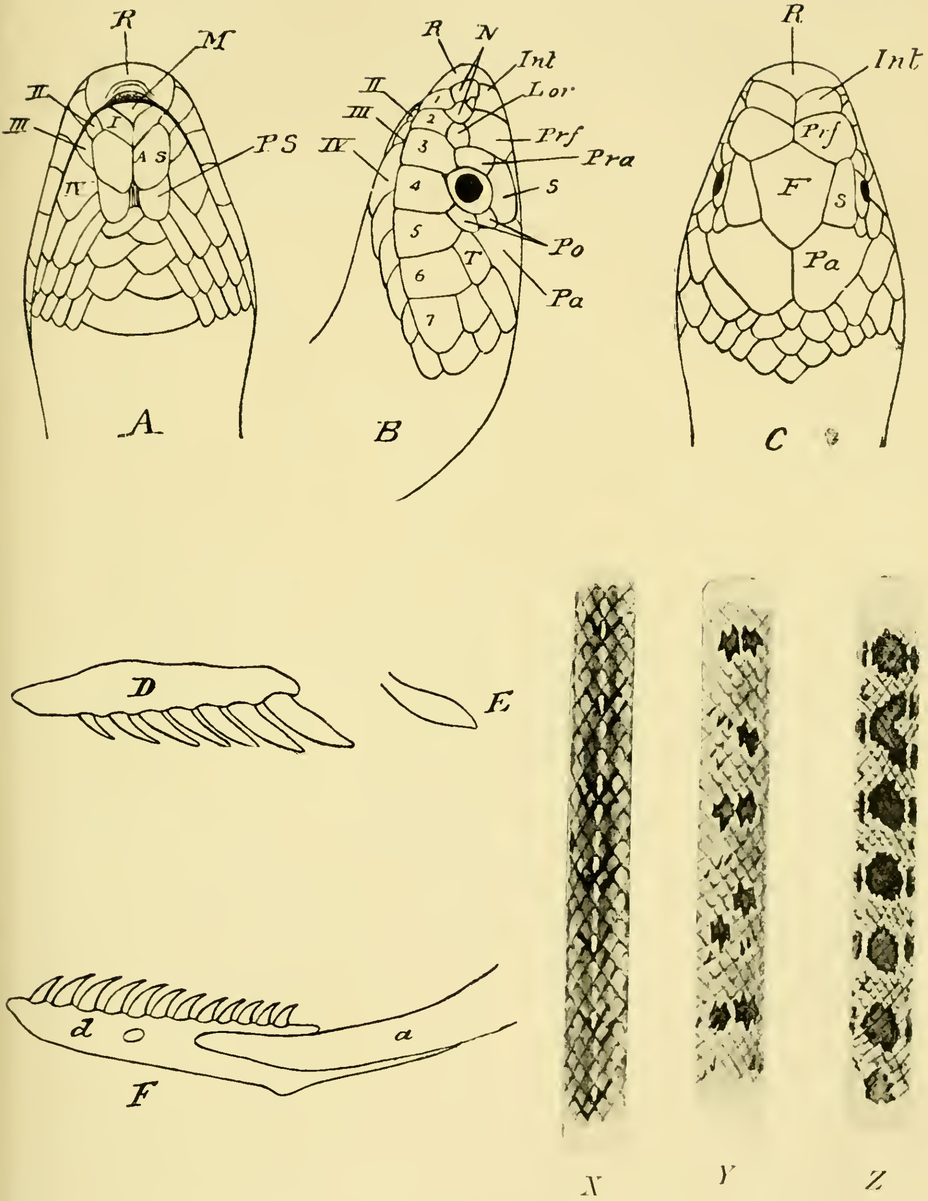
[*] My doubts are the outcome of a study of the skulls of 5 species of these genera in my collection. Günther (Rept. Brit. Ind., p. 205) divided the genera on the palatine teeth including as *Simotes* all those species in which these teeth were present, and reserving the name *Oligodon* for those in which they were absent. Boulenger (Cat., pp. 215 and 233) finding that species which he considered *Oligodon* on other grounds possessed two or three palatine teeth, divided the genera on the presence or absence of the pterygoid teeth, conceding the name *Simotes* to the former, and *Oligodon* to the latter, and supplemented this arrangement by the number of the maxillary teeth, 6 to 8 being present in *Oligodon* and 8 to 12 in *Simotes*. As a matter of fact neither arrangement is tenable as both palatine and pterygoid teeth are present in two out of three of the species in my collection which Mr. Boulenger considers *Oligodon*, viz., *subgriseus*, and *venustus*. In the third case (*dorsalis*) their absence is doubtful.

[†] Ind. Serp., Vol. 1, Plate XIX.

[‡] J. A. S., Bengal, XXII, p. 528.

[§] J. A. S., Bengal, XXII, p. 528 (not to be confused with the *Coronella tæniolata* of Bœttger which is the *Rhadinea undulata* of Brazil under present day nomenclature).

[¶] VII., p. 59.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OLIGODON SUBGRISEUS.

A. B. C.—Head shields (× 3).

D.—Maxilla.

E.—Outline of blade of kukri.

F.—Dentary (*d*) and part of articular (*a*) bones of mandible (much enlarged).

X. Y. Z.—Colour varieties

and *Simotes*, because the hindmost maxillary teeth are remarkably flattened (compressed) and their outline and blade-like character remind one forcibly of a goorkhas kukri. (See Figs. D and E of Diagram.)

(*c*) *Vernacular.*—According to Russell "wanapa pam" is the name applied to it by the natives about Vizagapatam. In Cannanore I heard it called "choorta" a term under which *Lycodon aulicus* is also confused.

Dimensions.—Adults are usually from 15 to 18 inches in length. The longest I know of is 1 foot 9¼ inches from Hyderabad (Sind).

General characters.—It is rather slender, and graceful in form and noticeable in possessing no indication of a neck. The girth is wonderfully uniform in the whole body length, the trunk round in section and smooth. The head is short, the muzzle truncate, and the eye small with a golden iris, and round pupil. The tail is short accounting for about one-seventh of the total length of the snake.

Identification.—It is the only snake to be found in the Plains of the Indian Peninsula in which the scale rows are 15 in the whole body length, and the anal shield divided with three possible exceptions. In Sind *Contia walteri* has been recorded a snake in which the subcaudals number from 73 to 82 ; in *subgriseus* they vary from 38 to 56. In the Himalayas from Simla to Darjeeling *Ablabes rappi* occurs, a mountain form which might straggle towards the adjacent Plains. This snake has only 6 supralabials, but *subgriseus* has 7. In Southern India *O. ellioti* may be confounded with it, but in possessing less than 31 subcaudals can be at once distinguished. Farther it is highly probable that this rare snake is a mountain form. It is only known from two specimens, the exact habitat in both instances not being on record.

In Ceylon it may be confused with its allies *O. sublineatus*, and *O. templetoni.* In both these species however the subcaudals number less than 35.

Colour and markings.—Like many of the other snakes I have dealt with in these papers, *O. subgriseus* presents considerable differences in its colour and markings. Of the various forms I think four deserve special mention but the fact that the first three of these are completely connected shows they are all merely variations of a single variety. The fourth form is, I think, probably a distinct species as

Günther originally believed it, however I prefer for the present to leave it as placed by Boulenger.

VARIETY A.—Body striped longitudinally. The belly unspotted.

Subvariety (*a*).—Striped longitudinally with no variegation, and few and obscure, or no cross-bars. (Fig. 2 of our Plate.)

Subvariety (*b*).—More or less variegated with short, oblique, lighter and darker streaks, which tend to arrange themselves into cross-bars. More or less distinctly striped longitudinally. (Fig. X of Diagram.)

Subvariety (*c*).—Like the last but with twin roundish spots placed side by side on the back. (Fig. Y of Diagram, and Fig. 1 of Plate.)

VARIETY B.—With a median dorsal series of roundish spots. No longitudinal stripes. Belly spotted near the edge of most of the ventrals. (Fig. Z of Diagram.)

Subvariety (*a*).—We have shown a good example in figure 2 of our plate. The ground colour is buff, and four more or less obvious pale brownish stripes pass down the body. The two upper and broader pass from the nape where they are confluent to the tail tip. On the body they involve the edge of the vertebral, and the two and a half adjoining rows. The lower and narrower stripes pass from the neck to the vent, and are placed on the contiguous halves of the 2nd and 3rd rows above the ventrals. The pale vertebral line is continuous, and confined to the middle of the vertebral row except anteriorly where it expands to the margins of the uppermost costal row. In many of these specimens, and perhaps in all an indication of the cross-bars typical of the next form may be seen if looked for in the anterior part of the body. The belly is pearly-white and unspotted. The head is marked with 3 dark chevrons; of these the anterior passes across the præfrontals, and reappears beneath the eye, the median has its apex on the frontal shield, and its limbs pass obliquely backwards to the gape, frequently blending with the posterior, which is the broadest and situated on the nape, its apex extending forwards to the parietals. These chevrons are usually complete, and discrete but may be more or less incomplete, or confluent. A dark streak (omitted by our artist) is always present on the 6th, or between the 6th and 7th supralabials, and there is frequently a streak in the suture between the 1st and 2nd supralabials. This form appears uncommon, and I only know of it from Ceylon.

Subvariety (*b*).—*Forma Typica.* This is the *tæniolata* of Jerdon and is well figured by Russell.* It is the variety A of Boulenger. The ground colour is buff, pale brown, cedar-brown, or more rarely a light dun. There is a conspicuous variegation caused by lighter and darker streaks on the anterior-inferior margins of some of the scales. The darker streaks show a marked tendency to congregate at intervals and arrange themselves into cross-bars, which are usually narrowly outlined with buff. These cross-bars narrow or actually break up in the flanks, and are often rather ill-defined. In many specimens an intermediate series of a less distinct character alternate with them. If looked for longitudinal stripes similar to those in subvariety (*a*) are, I think, always apparent, though often obscure, and the vertebral streak is often interrupted. The belly is unspotted, and the head marks as in subvariety (*a*). It is much the commonest form, and the most widely distributed. Russell's specimen was from Vizagapatam,* and Jerdon recorded it from Madras.* Blanford obtained it in Ellore and Ajmere†. In our Society's collection there are specimens from Bombay, Deolali, Karwar, Khandal'a, Khandesh, and Goa Ghats. I have lately seen a specimen in the Indian Museum from Dhikala (Garhwal District) and have acquired specimens myself from Delhi, Cannanore, Madras, Trichinopoly, Tuticorin, Vizianagram, Hyderabad (Sind), Dehra Dun and Shembaganur. In the British Museum it is recorded from the Anamallays.‡

Subvariety (*c*).—Figure 1 of our Plate. This is the *dubium* of Jerdon and the *spilonotus* of Günther.§ This form is very similar to the last but the cross-bars are modified to form two or four more or less confluent or completely detached roundish spots, the median of which are larger, and better defined, the lateral often being ill-defined or irregular in form. These marks remind one forcibly of a similar ornamentation seen in *O. venustus*, *Simotes splendidus* (Günther) and *S. albocinctus* variety *juglandifer* (Wall). Longitudinal stripes as in the previous forms are usually apparent if looked for. The vertebral streak is often more or less interrupted. The belly is unspotted, and the head marks are as in form (*a*). Jerdon's specimen was from Canara.

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* Loc cit.

† J. A S., Bengal, XLVIII, pp. 114 and 125.

‡ Günther. Rept. Brit. Ind., 1864, p. 207 and Plate XIX, fig. F.

§ But not the *binotatus* of Dumeril and Bibron as erroneously supposed by Boulenger (Cat., Vol. II., p. 243) This last is without doubt synonymous with *Simotes venustus* having, it is stated, 17 scale rows.

I have had it from Matheran and there are specimens in our Society's collection from Bombay and Satara.

Our coloured figures are taken from a specimen which does not show the arrangement of the dorsal marks in their most typical form, though the tendency to division in the cross-bars is obvious. Figure 1*b* is most misleading in the arrangement of its spots which are obviously from a very unusual specimen. It is to be regretted too that the longitudinal striping which Mr. Gerhardt showed so nicely in his original sketch has not been reproduced by our London artist, thus detracting from the latter's good work. Fig. Y of our diagram is very typical.

VARIETY D.—Boulenger's variety B.* The *fasciatus* of Günther. The ground colour is buff or pale yellowish-brown. A median series of largish, well-defined, round spots passes down the back, some of the anterior ones being often divided. Outside these are irregularly shaped, ill-defined, smaller, dark marks. There are no longitudinal stripes down the body, and any variegation noticeable is confined to the flanks. There are spots near the edge of most of the ventrals on each side. The head marks are as in the foregoing. The specimens recorded by Günther are from the Deccan and Matheran. Others have been recorded from Bombay† and Poona‡.

Though *subgriseus* is a common snake it will be seen that the records I have quoted above are rather meagre. This is due to the fact that many writers have not recorded the variety met with nor described the colouration sufficiently to enable me to place them with the above varieties.

Haunts.—I know nothing that calls for special remark, beyond that it is evidently a snake of the Plains, but wanders into the Hills. I have a specimen (var b) from Shembaganur Palney Hills (circa 6,300 ft.) It is, I believe, not a jungle snake, but one that prefers open country where its sombre colouration is in harmony with a barren soil.

Disposition.—The few specimens that have come into my hands alive have all been particularly well behaved, allowing me to handle them freely without attempting to bite. Mr. Gleadow, however, in a letter to our Society mentions one that he wounded and attempted to carry home over a stick, but which repeatedly fell off and in replac-

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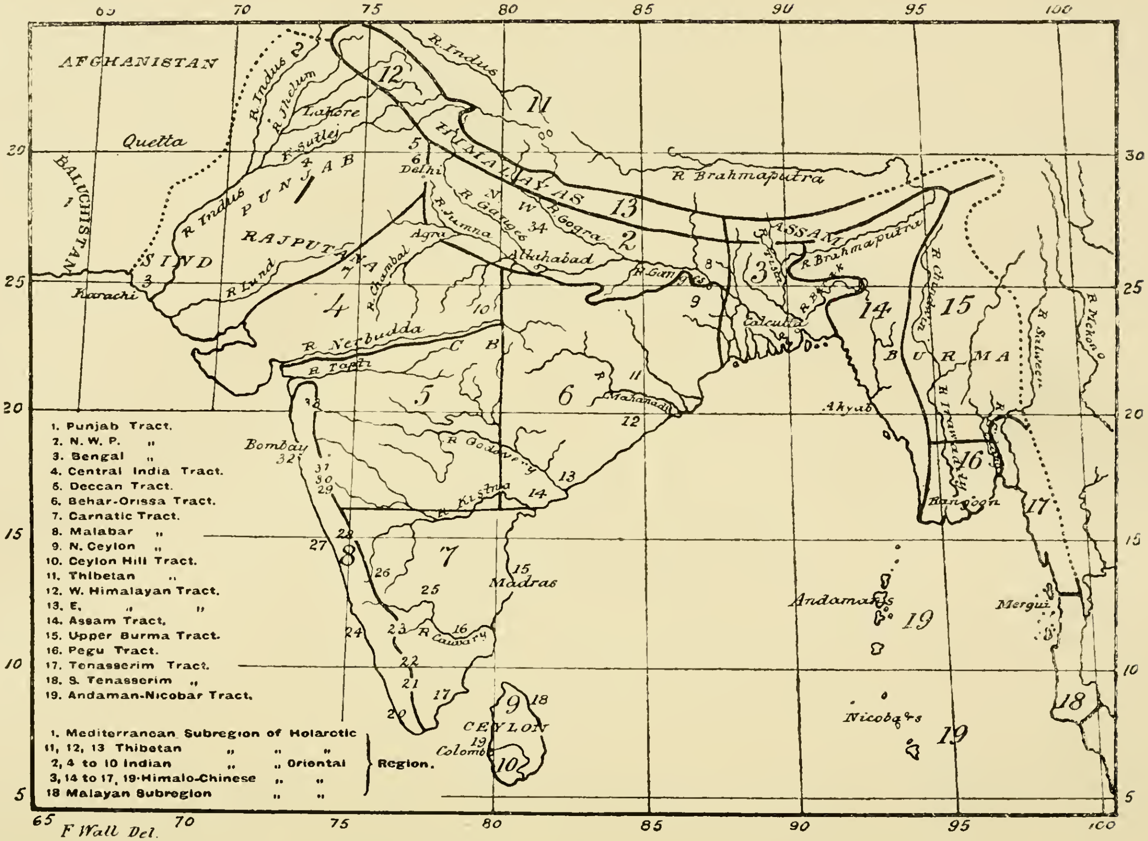
* Loc. cit.

† Bomb. Nat. Hist. Jourl., Vol. I, Cat. of Snakes. ‡ *Ibid.*, Vol. III, Cat. of Snakes.


1. Punjab Tract.
2. N. W. P. "
3. Bengal "
4. Central India Tract.
5. Deccan Tract.
6. Behar-Orissa Tract.
7. Carnatic Tract.
8. Malabar "
9. N. Ceylon "
10. Ceylon Hill Tract.
11. Thibetan "
12. W. Himalayan Tract.
13. E. " "
14. Assam Tract.
15. Upper Burma Tract.
16. Pegu Tract.
17. Tenasserim Tract.
18. S. Tenasserim "
19. Andaman-Nicobar Tract.
1. Mediterranean Subregion of Holarctic
11, 12, 13 Thibetan " " "
2, 4 to 10 Indian " " Oriental
3, 14 to 17, 19 Himalo-Chinese " "
18 Malayan Subregion " "
Region.
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BALUCHISTAN
Quetta
Karachi
SIND
PUNJAB
RAJPUTANA
HIMALAYAS
ASSAM
BURMA
CEYLON
Lahore
Delhi
Agra
Allahabad
Calcutta
Bombay
Madras
Colombo
Akyab
Rangoon
Mergui
Andamans
Nicobars
R. Indus
R. Jhelum
R. Sutlej
R. Jumna
R. Ganges
R. Gogra
R. Brahmaputra
R. Chambal
R. Nerbudda
R. Tapti
R. Godavery
R. Kistna
R. Cauvery
R. Mahanadi
R. Chindwin
R. Irrawaddy
R. Salween
R. Mekong
F Wall Del.

Map showing Distribution of Oligodon subgriseus.

(**The black numerals show localities it is known from.**)

ing it "savagely attacked" him twice. It is a quietly disposed creature with sufficient spirit however to resent interference, and prompt it to make active attempts to escape when encountered.

Habits.—My acquaintance with the species in life is too limited to give any information in this direction, but it appears to be diurnal and of a retiring habit.

Food.—I have never found anything in the stomach.

Breeding.—Of the specimens I have collected myself, and sexed only two were ♀, and in neither case was the subject gravid. My smallest specimen which I believe to have been a hatchling measured $4\frac{13}{16}$ inches and was obtained at Cannanore in March. I have had two other small examples one from Dehra Dun measuring $6\frac{1}{4}$ inches in July, the other from Cannanore measuring $6\frac{1}{16}$ inches also in July. These notes seem to indicate that the young appear (probably hatching out from eggs) about March.

Distribution.—As will be seen from the accompanying map it occurs in Trans-Indus, in the Indus Basin, the whole of Peninsular India up to the base of the Himalayas as far East as Purneah, and in Ceylon. Variety A occurs throughout the area noted above, but Variety B appears to be peculiar to the Island of Ceylon, and the hills skirting the Malabar Coast as far North as Matheran. The exact localities are as follows and are numbered in black on the map. 1 Khila Abdullah (I. M.), 2 Malakand (I. M.), 3 Karachi (I. M. and B. M.), and Hyderabad (F. W.), 4 Rajanpur (I. M.), 5 Dehra Dun (I. M. and F. W.) and Dhikala (Garhwal Dist.) (F. W.), 6 Delhi (F. W.), 7 Ajmer (B. M.), 8 Purneah (I. M.), 9 Barrakur (I. M.), 10 N. Godavery District (I. M.), 11 Chota Nagpur (I. M.), 12 Aska (B. M.), 13 Vizagapatam (Russell) and Vizianagram (F. W.), 14 Ellore (Blanford), 15 Madras (B. M.), 16 Trichinopoly (F. W.), 17 Tuticorin (F. W.), 18 Trincomalee (B. M.), 19 Colombo (Haly. Cat. Snakes, Colombo Mus., 1886, p. 8), 20 Trivandrum (Ferguson, Bomb. N. H. Jourl., Vol. X, p. 71), 21 Travancore Hills (Ferguson, Loc. Cit.), and Permade (I. M.), 22 Anamallays (B. M.), 23 Nilgiris (B. M.), 24 Cannanore (F. W.), 25 Bangalore and Koppa (I. M.), 26 Wynad (B. M.), 27 Karwar and Goa Ghats (Bo. M.), 28 N. Canara (Jerdon), 29 Matheran (Bo. M.), 30 Poona (Bo. M.), 31 Deolali, Khandalla, Satara (Bo. M.), 32 Bombay (Bo. M.), 33 Khandesh (Bo. M.), 34 N.-W. Provinces and Oudh (Murray, Zool., Sind, p. 375).

NOTE.—B. M. implies British Museum ; I. M. Indian Museum ; Bo. M. Bombay Society's Museum.

Lepidosis. Rostral.—Touches 6 shields, the rostro-nasal, and rostro-internasal sutures subequal or the latter longest ; the portion visible from above one half (or nearly) the distance from the end of the snout to the frontal. *Internasals.*—Two, the suture between them, equal to or nearly one half the suture between the præfrontal fellows ; half or less than half the internaso-præfrontal sutures. *Præfrontals.*—Two, the suture between them half or less than half the præfronto-frontal sutures ; in contact with internasal, posterior nasal, loreal, præocular, supraocular, and frontal*. *Frontal.*—Touches 6 shields, the supraocular sutures rather the longest. *Supraoculars.*—Length subequal to frontal, breadth about half that of the frontal. *Parietals.*—Touch one or two postoculars. *Nasals.*—Divided ; in contact with the 1st and 2nd supralabials. *Loreal.*—One, small, as long as high, little longer than half the nasals (rarely confluent with præfrontal, Günther). *Præoculars.*—One. *Postoculars.*—Two (rarely three). *Temporals.*—One, touching the 5th and 6th supralabials. *Supralabials.*—7 (rarely 6 or 8), the 3rd and 4th touching the eye (or 3rd only in rare examples owing to a confluence of two of the normal shields). Rarely the 6th shield just fails to reach the labial margin. *Infralabials.*—4, (rarely 5), the 4th largest, and in contact with two scales behind. *Sublinguals.*—Two pairs, the posterior about two-thirds the anterior, and in contact with the 4th only of the infralabial series. *Costals.*—15 in the whole body length, the last row slightly enlarged ; no keels ; apical pits present, and single. *Ventrals.*—Angulate. In Variety A. ♂ 158 ? to 184, ♀ 158 ? to 218.† In Variety B ♂ 158 to 169, ♀ 174 to 184. *Anal.*—Divided (rarely entire). *Subcaudals.*—Divided. In Variety A they are 38 to 55 in ♂, 37 to 52 in ♀ ; in Variety B 38 to 46 in ♂, 36 to 40 in ♀.

Dentition (a) Maxillary.—The maxilla has an edentulous space anteriorly which would accommodate about 3 teeth of the size of the foremost of the series. It supports 6 or 7 very compressed teeth of syncranterian type (*i.e.* rapidly increasing in size from before backwards). The *palatine* bone supports a single small tooth (sometimes none ?) situated about the middle of its length. The *pterygoid* series number 6 to 10 *, and are preceded by a long edentulous space. The *mandibular* series number about 12, which are compressed, rather small and subequal. A short edentulous space that would accommodate about one tooth precedes the dental array. (See Figs. D and F of Diagram).

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* In one specimen of Variety B in our Society's collection these shields are completely separated by the frontal.

† The number of the ventrals varies somewhat according to locality. In the Oriental Region they range between 158 ? and 184 in ♂, and 158 ? and 204 in ♀, but in the Indus and Trans-Indus tracts a ♂ has 186, and the range for 4 ♀ is 200 to 218.

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* Boulenger says (Cat. Vol. II., p. 233) that there are no pterygoid teeth in the Oligodontides, but he is mistaken. In the three species of which I have skulls (*subgriseus*, *dorsalis* and *venustus*) pterygoid teeth are present.

(*To be continued.*)

THE BUTTERFLIES (*RHOPALOCERA*) OF THE NIMAR DISTRICT, CENTRAL PROVINCES.

BY

D. O. WITT, I.F.S.

In 1905 when I took over charge of the Nimar Forest Division it occurred to me that a collection of the *Rhopalocera* of the District might achieve some interesting results. The peculiar position of Nimar at the extreme western corner of the Province as well as the very dry nature of the climate led me to hope that the District might be found to contain species not usually met with in the moister parts of the Provinces.

I commenced in the rains of 1905 and had soon collected the commoner species which are found everywhere. It was amongst the *Lycœnidæ* however that I expected to find most scope for my energies. Unfortunately, however, I was unable to carry through my intended programme. My official duties as well as the preparation for Government of a Forest Flora of the District took up most of my time and I was only able to devote odd periods to the *Rhopalocera*. Although I was 4 years in the District, in the end my collecting was all done in the rains and early cold weather of 1905 and 1907. The list attached must therefore be looked on as very incomplete; at the same time I trust it may prove of interest to some readers of the Journal.

The naming of the different species presented no very great difficulty except for the *Lycœnidæ*. "The Butterflies of India" by Marshall and deNicèville, and Colonel Bingham's "Butterflies" in the Indian Fauna series were made use of. Unfortunately this latter is incomplete and does not include the *Hesperiidæ*. The Hony. Secretary of the Bombay Natural History Society very kindly gave me what assistance he could in the matter and was able to get a few specimens named by Mr. Lefroy, but even this assistance brought to light how extremely backward we are and how little we really know about the *Lycœnidæ* and *Hesperiidæ*. There must be a large field for enquiry lying open here for anybody who has the opportunity or the time to enter it.

Before proceeding to an enumeration of the species a short description of the situation and physical features of the District, as well as the climate are necessary to make the list of any value at all.

The Nimar District is situated between 21° 5′ and 22° 25′ N. and 75° 57′ and 77° 13′ E. and occupies a strip of mixed hill and plain country at the western extremity of the Nerbudda valley and of the Satpura plateau, and abuts on Khandesh and the Central India States. It is bounded on the North by the Indore State, on the West by Indore and Khandesh; on the South by Khandesh and Berar; and on the East by the Hoshangabad and Betul Districts of the C. P.

Almost through the centre of the district from West to East runs a branch of the Satpuras forming the water-shed between the Nerbudda river on the North and the Taptee on the South. The whole of this ridge is covered with dry deciduous forest. Mandwa, a station on the G. I. P. Railway, as well as the hill fort of Asirgarh are situated within this block of forest. Between this range of hills and the Nerbudda lies the town of Khandwa in a broad and fertile valley. The drainage from the central ridge to the North is diverted from its direct course by another low and irregular ridge also covered with forest. North of this ridge and bordering the Nerbudda river is a strip of broken and hilly ground from 3 to 6 inch wide forming the Government Forest Reserve of Punasa.

On the North bank of the river and to the East is situated the Chandgurh Forest Reserve on the continuation of the hills constituting the Punasa Reserve.

Along the Southern face of the main central branch of the Satpuras runs the Taptee and on its banks at the extreme South-Western corner of the district lies the town of Burhanpur.

South of this river rises a higher ridge forming the Southern face of the Satpuras, and separating Nimar from the Berar plain. A deep fertile valley separates these two branches of the Satpuras. The average elevation of the plain portion of the District is 900 feet. Such are the main physical features of the District.

The climate is extremely dry, the average rainfall for the last 40 years being only 30 inches though it has varied from as much as 52 inches in 1894-95 to as little as 10 inches in 1899-1900. The rains usually cease at the end of September and as winter rains seldom occur it is practically rainless from then until the middle of June. The average maximum temperature of the hot weather months is 106°. The days are hot but the nights are always cool.

The cold weather which lasts from the beginning of November to the middle of March though not bracing is distinctly pleasant. Frosts occur in low lying localities in the forests.

With this introduction I now proceed to the enumeration of the species.

I.—NYMPHALIDÆ.

1.—DANAINÆ.

Danais limniace, Cr.

Common, especially in gardens, from July to November.

Danais chrysippus, Linn.

Common everywhere throughout the year.

Danais plexippus, Linn.

Almost as common as preceding.

Euplœa core, Cr.

Common everywhere, rains and cold weather. The larvæ feed on the Oleander (*Nerium odorum*).

2.—SATYRINÆ.

Ypthima asterope, Klüg.

Taken at Khandwa in Public Gardens in October, but also seen in forest land. Generally keeps low down amongst grass and is easily overlooked.

Melanitis ismene, Cr.

Common everywhere almost all the year round, especially in shady jungle. Also of crepuscular habit.

3.—ACRÆANÆ.

Telchinia violæ, Fabr.

Local. Common in the Chandgurh Reserve in November. Also taken at Burhanpur. Easily taken owing to its slow weak flight.

4.—NYMPHALINÆ.

Byblia ilithyia, Dr.

Common on waste land round Khandwa in September-October. Larva probably feeds on *Tragia cannabina* which is common here. The females are not nearly so numerous as the males, and are generally taken in a battered condition.

Atella phalanta, Dr.

Common everywhere throughout the year.

Junonia almana, Linn.

Not very common. In clearings in jungle. Cold weather.

Junonia lemonias, Linn.

Common everywhere all the year round. In forest and open situations.

Junonia hierta, Fabr.

Common. Partial to open grassy jungle.

Junonia orithyia, Linn.

Common. Prefers hot, dry, bare situations, settling as a rule on a stone or on the ground. It requires some catching owing to the sharp sudden nature of its flight but it quickly settles again.

Neptis eurynome, West.

Fairly common in forest areas.

Hypolimnas bolina, Linn.

Common, especially in gardens.

Hypolimnas misippus, Linn.

Common everywhere in the rains and cold weather.

The females, which are almost exact "mimics" of *D. chrysippus*, are not so numerous as the males.

Euthalia nais, Moore.

Fairly common in glades in open forest, settling on moist ground along nullahs. Seldom seen in gardens or near habitations. Dry season.

Vanessa cardui, Linn.

Common in open situations from August to January, associated with *Junonia lemonias* and *orithyia*, which it resembles in its mode of flight and settling on rocks and stones. There appear to be a succession of broods of this species.

Charaxes athamas.

Not very common. In well wooded areas generally near water, settling on the moist ground in company with *P. agamemnon*, *Terias hecube* and several species of *Lycanidæ*.

II.—LEMONIIDÆ.

1.—NEMEOBIINÆ.

Abisara sepecherius, Stoll.

I have seen specimens of this genus on several occasions settling on the leaves of Teak trees but never took any. I fancy they may all be referred to this species.

III.—LYCÆNIDÆ.

Chilades laius, Cr.

Fairly common in rains and cold weather. Mandwa and Burhanpur.

Chilades trochilus, Fre.

Common throughout the District chiefly in the dry season. One of the smallest of the common *Lycanidæ*. The row of jewelled spots on the underside of the hind wing are very characteristic and exquisitely beautiful.

Zizera maha.

Identified by comparison with specimens in Bombay Natural History Society collection, but I am doubtful of the locality and season.

Zizera lysimon, Hüb.

Fairly common. Khandwa and Burhanpur. Rains.

Zizera gaika, Tri.

Only taken at Khandwa in Public Gardens. October.

Azanus Jesous, Juerin.

Only taken once in August 1907 at Khandwa, on open ground.

Lampides bochus.

Rare. Taken once in September on Asirgarh and once at Burhanpur. The brilliant irridescent blue of the upper side makes this species a conspicuous insect.

Nacaduba ardates, Moore.

Not common, but fairly numerous where found. Mandwa. September.

Nacaduba pavana, Horsf.

Identified as such by Mr. Lefroy. Scarce. Burhanpur. September.

Catochrysops strabo, Fabr.

Fairly common. Rains and cold weather. Identified by Mr. Lefroy.

Catochrysops cnejus, Fabr.

Common everywhere, rains and cold weather. This and the following species are perhaps the commonest and most numerous of all the *Lycænidæ* excepting only *Tarucus theophrastus.*

Catochrysops pandava, Hors.

Common everywhere, rains and cold weather.

Tarucus theophrastus, Fabr.

The commonest *Lycænid* in the District. Found everywhere, rains and cold weather, especially on waste ground covered with *Cassia tora* and *Sophera*, commonly known as the wild Indigo, which is, I fancy, the food plant of the larvæ.

Tarucus plinius, Fabr.

Not so common as preceding. Burhanpur. September.

Polyommatus bœticus, Linn.

Only taken once at Burhanpur on 25th September 1907.

Aphnæus vulcanus, Fabr.

Identified as such by Mr. Lefroy.

This insect is fairly common in September-October when the Reunj (*Acacia leucophlæa*) trees are in flower and may then be seen in considerable numbers in company with other *Lycænidæ*, flying round these trees and settling on the flower heads.

I have also found it partial to the flowers of the Babul (*Acacia arabica*).

Tajuria jehana, Moore.

Not common. In open forest, settling on the leaves of trees at a height of 8 to 10 feet from the ground and if disturbed taking a short rapid flight and returning to the same tree. In each case that I came across the insect it had chosen the Saj (*Terminalia tomentosa*) as its resting place. With patience it is possible to capture every single insect on one tree so pertinacious are they in returning to the same spot. Punasa and Mandwa. September. A particularly pretty insect with its pale blue upperside, and silver grey underside.

Curetis sp. ?

I have not succeeded in getting this insect identified. The general colouration is copper-brown above with black borders to the wings and almost immaculate silver grey below. This insect was equally common with *Aphnæus fusca* on the *Acacia leucophlœa* trees when in flower in September-October ; round Khandwa.

Arhopala sp. ?

(Writing without reference books I am uncertain about the position of this genus.) On a solitary occasion saw a specimen of what I feel sure was a species of *Arhopala* settling on moist ground in a nullah in fairly dense mixed forest, close to the Nerbudda, in November.

IV.—PAPILIONIDÆ.

1.—PAPILIONINÆ.

Papilo aristolochiæ, Fabr.

So named from the *Aristolochia indica* on which the larvæ feeds. This is the common black swallow tail with red spots on the hind wing. Common especially in gardens throughout the rains and most of the cold weather.

Papilio hector, Linn.

Differs from the preceding in having distinct white blotches on the fore wings. Scarce. Taken in November near Chandgurh. Once seen at Khandwa in the Public Gardens.

Papilio demoleus, Linn.

This is the common black and yellow swallow tail, but without any tails.

Common everywhere especially in gardens, rains and dry season. In old specimens the yellow spots become very dark, almost ochreous, giving the appearance of a distinct species.

Papilio polytes, Linn.

More common in forest areas than in gardens and cultivated land. Of a skulking habit, keeping usually to forest with bushy undergrowth in it. Rains and cold weather.

Papilio agamemnon, Linn.

Not common. In forest areas usually near water, settling on the mud to suck up the moisture. A rapid flyer, difficult to capture.

2. PIERINÆ.

Delias eucharis, Dr.

Common in open forest wherever the parasite *Loranthus longiflorus*, on which the larvæ live, is prevalent. In Nimar this means chiefly in Salai (*Boswellia serrata*) forest. Rains.

The insect has a weak slow flight and is easily captured.

Anaphœis mesentina, Cr.

Common on open waste land, Burhanpur. Wet season form only taken.

Huphina nerissa, Fabr., var., *phryne* , Fabr.

Common, at least the males of both wet season and dry season form. No females taken.

Ixias marianne, Cr.

This is the common large Orange tip. Local, but common where it occurs. Burhanpur. Rains and cold weather.

Leptosia xiphia ? Fabr.

I have not taken this species but have seen it on one or two occasions amongst undergrowth in forest.

Appias libythea, Fabr.

Fairly common. Wet season form.

Catopsilia crocale, Cr.

Very common in waste places near habitations. Chiefly rains. The absence of brown strigæ on the underside of the wings serve to distinguish this from the following species.

Catopsilia pyranthe, Linn.

As common as preceding and in the same localities and same season. The larvæ feed on the various species of *Cassia* which are so abundant round villages and along roadsides.

The underside of the wings are covered with brown strigæ which vary extraordinarily in quantity and depth of colour.

Terias læta, Bois.

Fairly common throughout the District, at all times of the year.

Terias hecabe, Linn. Typical form.

Very common everywhere throughout the District in forest as well as open lands. Almost throughout the year.

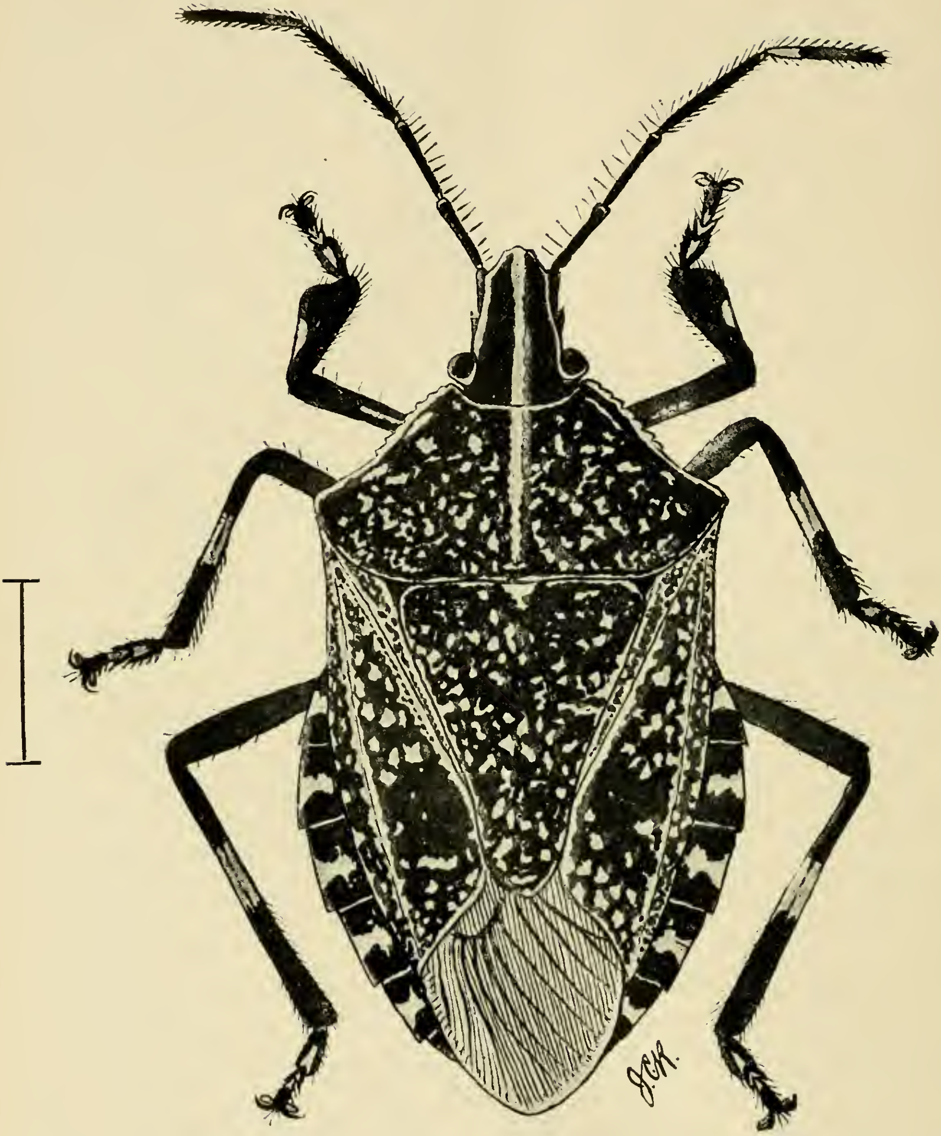
Var. asphodelus. Bahri, near the Nerbudda. November. No special attempt was made to collect the numerous varieties of this very variable insect.

Coletis amata, Fabr.

Scarce. One male at Burhanpur. October 1905.

Coletis vestalis, But.

Local. Fairly common at Burhanpur. September-October.



ORIENTAL HEMIPTERA (No. 4).

Erthesina fullo (Thunberg).

Coletis etrida, Bois.

Local. Taken at Serkia, Chandgurh Reserve, north of the Nerbudda, in November. The orange patch at the apex of the forewing serves to distinguish this from the following species.

Coletis danæ, Fabr.

Fairly common. Burhanpur; in large numbers. Also Singaji and Khandwa. September-December. The crimson patch at the apex of the forewing of the male is a distinguishing feature. In the females this patch varies greatly in colour and extent, sometimes it is quite orange and sometimes it is obliterated by black markings. A conspicuous and very pretty insect.

V.—HESPERIIDÆ.

Parnara mathias, Fab.

The common brown skipper with white spots. Identified by comparison with specimens in the Bombay Natural History Society collection.

In addition I have taken one or two other species of Hesperid *viz*:—

Parnara bevani, Moore.
and
Coladenia tissa, Moore.

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, No. 4

BY

J. C. W. KERSHAW AND G. W. KIRKALDY.

(*With Plates D and E and Text Figure I.*)

The fourth paper of this series deals with *Erthesina fullo* (Thunberg), a bug belonging to the family Cimicidæ and the tribe Halyini. It is distributed throughout India, Assam, Burma, Ceylon, the Andaman Islands, Java, Japan, Formosa, China and Hainan Island. Although so common and well distributed, there has apparently been nothing recorded of its metamorphoses, and the only note connected with it is by Distant (1879, P. E. S., London, p. lvii), who states that it is ground up into a kind of paste and eaten by the Nágas in Assam.

The following brief notes are taken from Chinese individuals, but will apply as well to Indian examples.

Erthesina fullo is very common throughout the wet season in Southern China, feeding upon the camphor tree (*Stillingia sebifera* Juss. N. O. Euphorbiaceæ), *Melia azedarach* and several other trees, when it appears specially to suck at the thick bark of the trunk, particularly where moss or lichen is growing. It also eagerly sucks moisture from bird-droppings, and if these are too dry, apparently moistens them with its own saliva, probing and working about the excrement with the tip of the setæ.

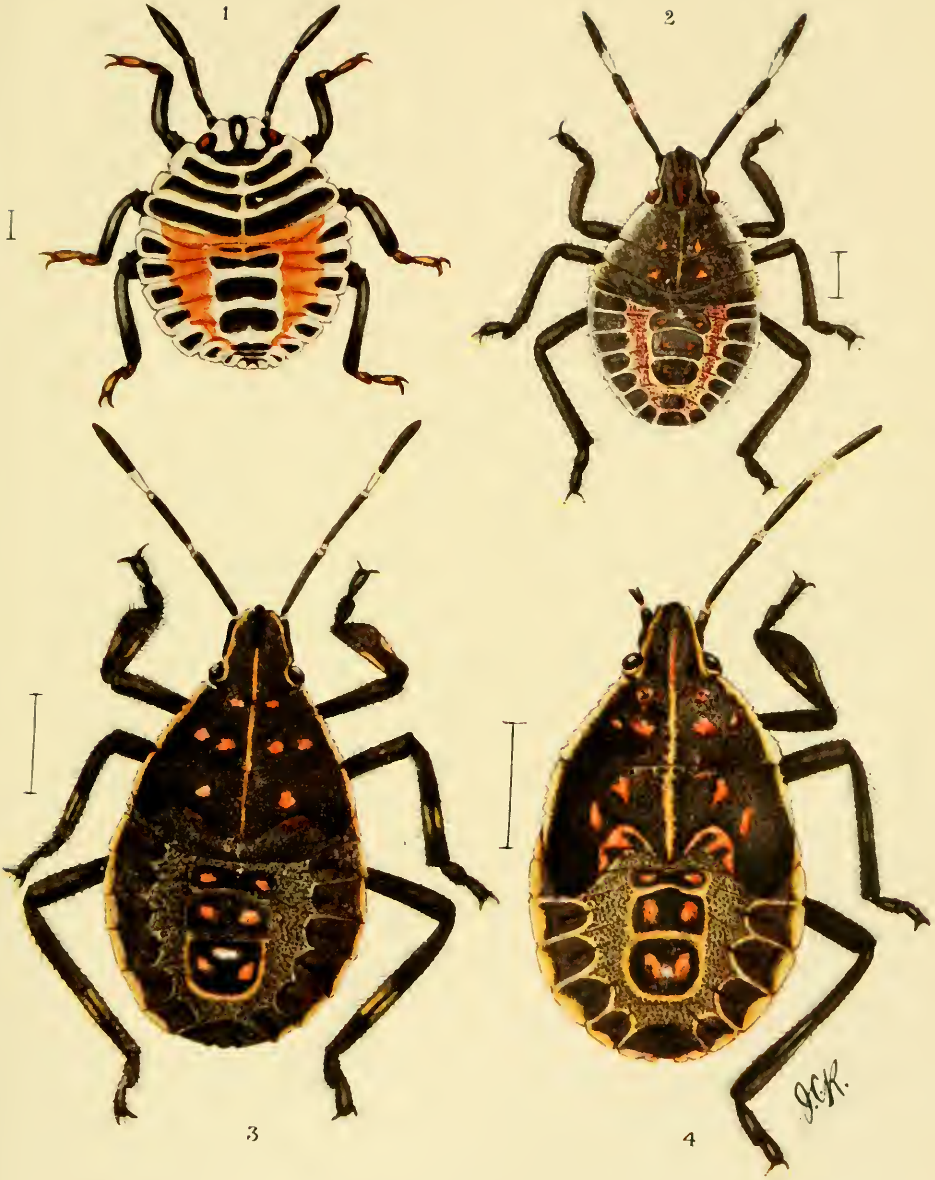
The adults of both sexes are very similar, the ground-colour being very pale yellow, the markings dark-brown and black. The basal part of the last segment of the antennæ is whitish. (Pl. D.)

The ova are pale greenish-yellow, of the usual Cimicid-type, laid in batches of about a dozen, touching one another, on bark or the underside of leaves. (Text fig. 1.) The eggs hatch in about six days, and the first moult ensues in about another four days, prior to which the young nymphs remain, as usual, quiescent over or around the eggshells, and do not feed. There are four nymphal instars, the nymphal period lasting about a month. When newly hatched, the external openings of the stink glands seem to be closed by a membrane, not being functional till after the first moult.

The other nymphs and the adults all have a very strong and unpleasant smell; this does not, however, exempt the insect from becoming the prey of certain carnivorous bugs, as I have seen a Reduvid sucking *Erthesina fullo*, whilst a swarm of tiny black flies crawled over the latter, and hovered in the air close around, as they sometimes do over the prey which a Mantis is eating.

The following points in the progressive development of the nymphs may be considered :—

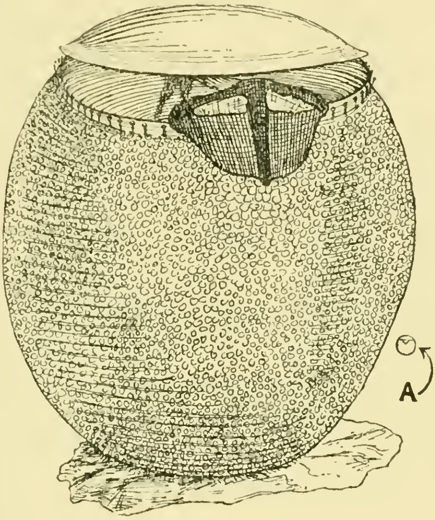
The first instar has the general appearance of the same stage in other Cimicid bugs. Dorsally it is rounded, the small head forming, roughly, a part of the lateral contour. The antennæ are short, the fourth segment tapering. The legs are stout and subcylindric. The general colouring is black and white, the abdomen suffused discally, except medially around the glandular flaps, with reddish (Pl. E., fig. 1). A quite different appearance is presented at the second instar. The contour is oval and the head instead of being rather sunk-in is elongate and placed outside the lateral contour. The general colouring is shown in the figure (2), in which also is shown the pale basal half of the fourth segment of the antennæ, which was practically entirely dark in the first instar. The legs are more elongate and show faint signs of dilatation.



ORIENTAL HEMIPTERA (No. 4)
Erthesina fullo (Thunberg).
NYMPHS

Engraved and
THE CALCUTTA PHOTOT

The third instar is still more elongate, and has the fore tibiæ very distinctly laminately dilated (fig. 3). The fourth instar is very similar to the third, except for the greater development of the tegminal pads (fig. 4). In the second, third and fourth instars, the lateral margins of the pronotum, etc., are increasingly strongly crenulate, this being apparently characteristic of many Cimicid nymphs in the older stages even when they are not crenulate in the adult ; in *Erthesina*, the adult also has these margins crenulate.



Text fig. 1.

Explanation of Figures.

Plate D.—*Erthesina fullo*, adult.

Plate E., fig. 1.—Nymph of the same, an hour or two after hatching.

,, 2.—Nymph of the second instar.

,, 3.—Nymph of the third instar.

,, 4.—Nymph of the fourth instar.

Text fig. 1.—Egg of the same, showing hatching-lever. **A** = natural size.

THE DRUGS OF SIRSI AND KAPPAT HILLS.

BY

L. B. Kulkarni, L. Ag.

At Sirsi and in the surrounding villages native medicine is practised to a considerable extent. The drugs used are chiefly forest products.

It is difficult to study the locally-used drugs botanically because they are imported from the forest to the shops, often in the form of chips of wood, twigs, or roots quite unidentifiable ; and though the native name is of much use, yet one can never be quite sure even that that is used correctly by the drug-seller. In the villages, however, one can occasionally get hold of a man who really knows the plants which are used.

There is a tendency at Sirsi for this lore to die out as a European dispensary has been opened. But in surrounding villages distant from Sirsi, the people use only the native drugs. The people are without any knowledge of human physiology and anatomy, and practise medicine only in accord with traditional knowledge. They are thoroughly acquainted with conspicuous and easily determined diseases such as dysentery and small-pox and seem to know something about these ailments ; but obscure diseases such as heart-diseases, hysteria and consumption are always referred to witchcraft or the action of devils and treated as such.

Some drugs from the Kappat hills are so highly valued that they are collected by people from considerable distances. About some drugs, the people there have such superstitious ideas that they never collect them without worshipping them and that too on a particular day.

In this short article, the drugs are classified according to their uses in local medicine. They were collected with the local names prevailing there. Some drugs could not be identified in the Herbarium, Agricultural College, Poona, as they had neither flowers nor fruits. The rest were identified and compared in the Herbarium by Mr. Paranjpe, Assistant Economic Botanist.

The drugs that are doubtful in identification are marked with the sign (?), and the drugs that could not be identified botanically have been given only the local names.

Febrifuges.

Owing to the cold climate in Sirsi and the surrounding district the people frequently suffer from cold fever for which the following drugs are used.

Bile misani (Vern.)—The bark of this plant is rubbed in lemon juice; and the juice is given to the patient to lick. It removes bad taste in the mouth, and is administered in the morning.

Nigella sativa (Ranunculaceæ).—A decoction of the leaves and seeds in water is made and one-eighth of the water is allowed to evaporate; the remainder is administered in the morning.

Coleus aromaticus (Labiatæ.)—Annual herb with thick leaves. The leaves pounded with jaggery are eaten for beneush cold.

Manikya (Vern.).—The root is rubbed in lemon juice and the juice is given to drink.

The leaves have got such a strong smell that they are used to drive away bees from hives while collecting honey.

Tinospora cordifolia (Menispermaceæ).—The decoction of the cortex is used.

> Watt. Vol. 6, Part IV, p. 470.—Stem, leaves, root and watery extract of the plant are useful as alteratives, and tonics, in general debility, fever and jaundice, skin disease and rheumatism, urinary disease and dyspepsia.
>
> The root is used for snake bite.
>
> Malaya States Bulletin No. 7, Vol. V, p. 246.—This drug is used also in Malaya States for the above diseases.

Clerodendron inerme (Verbenaceæ), *Acacia lanceolata* (Leguiminosæ) and *Nelayingala* (Vern.).—These three plants are well pounded and powdered and this powder is used for smoking to remove fever.

> Watt. Vol. II., P. 372.—The above first mentioned drug is used as febrifuge in remittent and intermittent fevers.

Indigofera paucifolia (Leguminosæ).—The powder of the root is administered in sheep's milk.

Toothache.

Barleria prionitis (Acanthaceæ).—Pills made from the leaves pounded with salt are administered to keep in the mouth. The pills are as big as bōr fruits (*Zizyphus jujuba*) and produce salivation.

> Watt, Vol. I, p. 400.—Juice of leaves is used for catarrhal affections of children accompanied with fever and phlegm. Again, to harden the feet in rainy season to prevent cracks.

Clematis hedysarifolia (Ranunculaceæ).—Chips of the wood are held in the mouth.

Wrightia tomentosa (Apocynaceæ).—A tree of the Kappat hills. The leaves with salt are administered to keep in the mouth.

Eye disease.

Jasminum malabaricum (Oleaceæ)—The juice of the stem is blown into the eye affected by cataract; this is continued for a week. The eyes are not exposed to the light during treatment.

Acacia sp. ? (*Vern. Kàswad*) (Leguminosæ) and *Barleria prionitis* (Acanthaceæ).—The roots of these two drugs are rubbed in lemon juice and the juice is administered internally to persons suffering from jaundice.

Sponia anderesa (Celtideæ).—A small herb. Annual. The pulp of the leaves is administered externally for any kind of eye-disease.

Diet—Cocoanuts should not be eaten.

Spermacoce hispida (Rubiaceæ).—The juice of the leaves is squeezed into the ear opposite to the eye affected. This is generally used for eye-diseases of cattle.

Watt. Vol. VI, Part III, p. 320.—Root is used as alterative.

Diseases of Infants.

Withania somnifera (Solanaceæ).—The root well ground and powdered is administered in human milk.

Watt. Vol. VI, Part IV, p. 311.—Root is used as tonic and diuretic ; the juice of the whole plant is used for rheumatism.

Mimusops elengi (Sapotaceæ).—The seed is rubbed once in human milk and then the milk is given to lick.

Watt. Vol. V, p. 249.—The bruised seeds free from kernels are used for constipation in children.

Malaya States Bulletin No. 6, Vol. V, p. 198.—The above drug is used for fever, diarrhœa and dysentery.

Crinum asiaticum (Liliaceæ).—The juice extracted from heated leaves is administered with jaggery for infantile asthma.

Watt. Vol. II, p. 589.—Leaves are used as an application to whitlows, and other inflammations at the end of toes and fingers ; and the juice of the leaves for ear-ache.

Head-ache.

Clematis hedysarifolia (Ranunculaceæ).—Chips of wood are well pounded and then aroma inhaled.

Areca catechu (Palmaceæ).

Tamarindus indica (Leguminosæ).

The nuts of the former and the seeds of the latter are triturated in cold water and the paste is applied to the head. (Said to be effective only in headaches to one side of the head.)

Madihāgalu (Vern.)—The root is rubbed in cold water and the paste is smeared on the head.

Applications for Sores and Wounds.

館Tabernæ montana (Apocynaceæ).—An ointment made from the ground bark and pepper is applied with cow ghee to wounds of any kind.

Watt. Vol. VI., Part III, p. 401.—Wood is used as refrigerant.

Clematis gouriana (Ranunculaceæ).—The whole plant well pounded and boiled with cow ghee (stale) is smeared with cocoanut oil on the wound.

Kadu padwal (Vern.)—The decoction of the whole creeper is administered.

Poultices for Abscesses, Swellings and Ulcers.

Lobelia nicotianæfolia (Campanulaceæ).—The root is rubbed in lime water (one tola water and $\frac{1}{96}$ tola lime) and the paste is smeared over the parts swollen.

Plumbago capensis (Plumbagineæ).—If the attack is severe the root of the above drug is mixed with the above medicament.

Watt. Vol. V, p. 86.—Infusion of the leaves is used as anti-spasmodic.

Pogostemon patchouli (Labiatæ).—The juice of the leaves is administered internally for black ulcers in the mouth.

Diet—Rice and milk.

Plumbago capensis (Plumbagineæ).—The root of this is rubbed in the juice of the leaves of *Leucas longifolius* (Labiatæ) and then the ointment is smeared on part affected.

Malaya States Bulletin No. 8, Vol. VIII, p. 272.—The above drug is used for the same disease.

Crotalaria verrucosa (Leguminosæ).—The juice of the crushed leaves is applied to abscesses.

Watt. Vol. II, p. 614.—The juice of the leaves diminishes salivation.

Holoptelea integrifolia (Urticaceæ).—The bark is applied to blisters.

Skin Disease.

Derris oblonga (Leguminosæ).—The seeds well pounded are roasted with teak oil (*Tectona grandis*) and then the ointment is applied to the skin for itch.

Hydnocarpus wightiana (Bixineæ).—The oil of the seeds is applied to the skin for itch ; and a little is also taken internally.

Watt. Vol. IV, p. 308.—Oil from seeds is used for dressing wounds, ulcers and skin diseases.

Cassia fistula (Leguminosæ).—The juice of the crushed leaves is used for ring-worm and nits.

Watt. Vol. II, p. 217.—Pulp of root, bark and fruit is used as purgative : and also as an external application for skin diseases.

Anodendron paniculatum (Apocynaceæ).—A paste is made by roasting the crushed leaves, cow ghee (1 lb.) alum and copper sulphate (each one gram.) and is applied as ointment for Isab (a skin disease).

Girardinia zeylanica (Urticaceæ).—The ash of dry fruits and leaves is applied in cocoanut oil for itch.

Adhatoda vasica (Acanthaceæ).—The leaves heated a little and then plunged in cocoanut oil, are applied for itch (especially for abdominal itch).

Watt. Vol. I, p. 109.—Leaves and root are used for Phthisis.

Snake Bite.

Jatropha panduræformis (Euphorbiaceæ).—The root is rubbed in lemon juice and then it is smeared over the part bitten ; a little is administered to drink.

This drug is not successful in the case of cobra bite.

Isari (Vern.)
Abrus precatorius, var. Alba (Leguminosæ).
Cryptolepis buchanana (Asclepiadeæ).
Achyranthus aspera (Amarantaceæ.)

The roots of these four plants are rubbed in lemon juice and then the semiliquid juice is administered internally ; a little should be applied externally. (Said to be effective especially in case of cobra).

Plumbago zeylanica (Plumbagineæ)—The root of this is similarly used.

Watt. Vol. VI, Part I, p. 295.—The drug increases digestive powers, promotes appetite and also it is useful in dyspepsia, piles, diarrhœa and skin diseases.

Venereal Diseases.

Tragia involucrata (Euphorbiaceæ).—The root is rubbed in cow milk and then the milk is administered internally. (It is also used as a general blood purifier).

Watt, Vol. VI, Part IV, p. 71.—Root is used as febricula and in itching of skin, and for venereal complaints. (The fruit rubbed over the head with little water is useful in baldness.)

Salacia prinoides (Celastrineæ).—A decoction of the root is administered with sugar.

Ranjiki (Vern).—Small pills of about two tolas each made from the crushed leaves and raw sugar are administered one daily.

Diet—Rice and butter-milk.

Diseases of Women.

Tabernœ montana (Apocynaceæ).—Lemon juice in which the root has been rubbed is given internally to women soon after delivery ; it is not allowed to touch teeth. This is administered for three days successively.

Malaya States Bulletin No. 7, Vol. V, p. 250.—The drug is useful in cough.

Eugenia jambolana (Myrtaceæ).—The bark taken out by means of stones from the eastern side of the tree trunk is crushed and stirred with cow milk and then filtered ; the filtrate is given daily in the morning for three days for irregular menstruation.

Diet—Cow milk and rice ; no salt is allowed.

Vangueria spinosa (Rubiaceæ).—Milk in which the leaves are crushed is administered internally.

Diet—Rice, milk, curds, and salt.

Kuntiganabalii (Vern.).—The creeper must not be gathered at the time of full moon following on a Sunday ; and it is tied round the wrist for puerperal fever.

Abrus precatorius, var. alba (Leguminosæ).—The root is tied round the wrist of pregnant women to hasten delivery.

Costus sp.—Cakes made from the tubers with the seeds of *Cuminum cyminum* (Umbelliferæ) and the kernels of cocoanuts *Cocos nucifer* (Palmaceæ) and well fried in ghee are eaten for their cooling effect by women in confinement.

Purgative.

Terminalia chebula (Combretaceæ)... ...
,, *catappa* (do.)... ...
Phyllanthus emblica (Euphorbiaceæ) ...
The powder of the seeds is given in hot water before going to bed.

Watt. Vol. VI, Part IV, p. 32.—The so-called *triphal* is used extensively with other medicines in almost all diseases.

Artemisia vulgaris (Compositæ).—The decoction of seeds is administered at night before going to bed.

Watt. Vol. I, p. 327.—The drug is stomachic, tonic and febrifuge.

Malaya States Bulletin No. 6, p. 203.—The drug is useful for colic.

Baliospermum axillare (Euphorbiaceæ).—Small quantities of root when taken internally cause purging.

Watt Vol I, p. 364.—Seeds are purgative.

Acacia oborata (Leguminosæ).—A powder made of the leaves mixed with ginger is taken before going to bed.

Watt. Vol. I, p. 53.—The drug is purgative.

Cholera.

Chakrāni (Vern.).—Lemon juice in which the root is rubbed is given to lick.

Aristolochia indica (Aristolochiaceæ).—The root is similarly used.

Watt. Vol. I, p. 315.—Stem and root are used for snake and scorpion bites internally and externally. It also produces abortion.

Rheumatism.

Terminalia chebula (Combretaceæ).—The fruits are put in hot ash, and taken out when sufficiently scorched; they are then rubbed in the juice of *Agave americana* leaves, heated; and the resulting liquid is rubbed over the body especially on the affected parts.

Watt. Vol. VI, Part IV, p. 32.—The drug is alterative, tonic, laxative and stomachic; it is also used in coughs, asthma and intestinal diseases.

Sida retusa (Malvaceæ).—The cooked pulp of the leaves is administered daily.

Vitex nergundi (Verbenaceæ).—A liniment made from the leaves boiled with sesamum oil is rubbed over the joints.

Watt. Vol. VI, Part IV, p. 248.—The root is tonic, febrifuge and expectorant; and the leaves are aromatic and vermifuge.

Pothas scandens (Aroideæ).—Cakes from the stem crushed with rice and udid (*Phaseolus mungo*) and fried in ghee are administered with seeds of *Cuminum cyminum* and butter of the she-buffalo.

Poisons.

Strychnos nux-vomica (Loganiaceæ).—The seeds with sweet oil act as a poison.

Watt. Vol. VI, Part III, p. 379.—Seeds are used for dyspepsia and diseases of the nervous system. On the Malabar coast the root is used for snake bite. In the Konkan small doses of seeds are administered for colic. The oil from the seeds is used for rheumatism.

Crinum asiatica (Amaryllideæ).—Poison.

Asthma.

Embelia ribes (Myrsineæ.)—Lemon juice in which the root is rubbed is administered with sugarcandy.

Bone Fractures.

Litsœa tomentosa (Lauraceæ).—The bark crushed in the juice of the kernel of cocoanut is administered in jaggery internally, and the bark crushed only in the above juice, is applied to the part of the fracture. The internal treatment is continued for three days and the external for nine days.

Gmelina arborea (Verbenaceæ).—The leaves crushed with fresh curds are administered internally. This is used also for cattle.

Watt. Vol. III, p. 514.—Root is tonic, laxative, stomachic and febrifuge.

Astringent.

Sideroxylon tomentosum (Myrsineæ).—The black seeds (3 or 4) should be rubbed in lemon juice which is given to lick.

Koade murakanaberu (Vern).—The bark crushed and rubbed in water is used for similar purpose.

Miscellaneous.

Elœagnus latifolia (Elæagnaceæ).—The bark crushed with *Sinapis juncea* seeds, garlic and pepper is mixed with water and then a drench of it is given to cattle to cure swelling of the stomach.

Mesua ferea (Guttiferæ).—The oil of the seeds is used for burning.

Hydrocotyle asiatica (Umbelliferæ).—The leaves if eaten daily sharpen intelligence and activity.

Watt. Vol. IV, p. 311.—Drug is stimulant.

Gardenia floribunda (Rubiaceæ).—The fruits rubbed in water are administered to lick as emetic.

Ankali (Vern.)—Sheep milk in which the bark is crushed is given to drink as an emetic.

Diet—Butter-milk and rice.

Rhus mysorensis (Anacardiaceæ).—The powder of the root is administered in cow milk as a cure for madness.

Anisomeles ovata (Labiatæ).—The leaves if burnt before a beehive drive away the bees. The juice smeared over the body prevents the attack of bee.

Watt. Vol. I, p. 255.—Distilled oil is carminative, tonic and astringent.

Chloroxylon swietenia (Meliaceæ)—The smoke of the leaves burnt drives away ticks from stables.

Watt. Vol, II, p. 270.—Leaves are applied to wounds.

Erythrina sp. var Alba (Leguminose).—Pieces of the stem are kept in stables to remove ticks.

Nakri (Vern).—The leaves are used for increasing the flow of milk both in women and animals.

Cardiospermum halicacabum (Sapindaceæ).—Leaves crushed are used for hydrocele.

Watt. Vol. II, p. 155.—Root is laxative, emetic, stomachic, rubifacient, diaphoretic, diuretic and tonic.

Smithia sensitiva (Leguminosæ).—Leaves if eaten daily keep the body cool and increase the flow of milk (especially used in case of cattle).

Asparagus racemosa (Liliaceæ).—Milk in which the root is rubbed is administered to keep the body cool.

Watt. Vol. I, p. 345.—Root is demulcent and also prevents confluence of small-pox.

Hemidesmus indicus (Asclepiadeæ).—The powder from the root, the bark of which is extracted, is stored as tea-powder and used as tea.

Watt. Vol. IV, p. 219.—Root is alterative and tonic and also useful in thrush of children.

Literature consulted.—(1) Dictionary of the Economic Products of India.

(2) Agricultural Bulletins of the Straits and Federated Malay States.

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DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

BY

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X.

EUCOSMIDÆ.

Epibactra, n. g.

Antennæ in ♂ minutely ciliated. Palpi moderately long, porrected, second joint dilated with rough scales above and beneath, terminal joint moderately long, slender. Thorax smooth. Forewings with 7 and 8 stalked. Hindwings with 3 and 4 separate, approximated at base, 5 closely approximated to 4 at base, 6 and 7 stalked.

Closely allied to *Bactra*, especially to the first two species described hereafter from which it only differs essentially by the stalking of veins 7 and 8 of forewings.

Epibactra arenosa, n. sp.

♂. 17-22 mm. Head, palpi, thorax, and abdomen whitish-ochreous, palpi sometimes partially tinged or sprinkled with fuscous. Forewings elongate, rather narrow, posteriorly somewhat dilated, costa gently arched, apex round-pointed, termen sinuate, little oblique; whitish-ochreous, partially tinged or mixed with brownish-ochreous, and with more or less pronounced traces of scattered strigulæ of fine blackish-fuscous irroration; costa marked throughout with short oblique strigulæ of fine blackish-irroration; some undefined brownish-ochreous suffusion towards costa on posterior half, sometimes mixed with fuscous, and an undefined similar spot in disc at $\frac{3}{5}$: cilia pale ochreous, tips infuscated on termen. Hindwings fuscous-whitish; cilia whitish-ochreous, with an indistinct fuscous line near base.

Maskeliya, Ceylon, in June and October (Pole); three specimens.

Bactra, Stph.

The species of this genus present considerable difficulties, being similar and variable, and close study is necessary to discriminate them. Ten are described here, but I do not find that any Indian specimens can be referred to the European *lanceolana*, Hb., or the African *siccella*, Walk. The form of wing and length of palpi are the most reliable characters, and must be carefully observed, but although the markings are usually vague and inconstant, they do notwithstanding present a distinct type in each species. In addition to those described I possess others of which the material is insufficient for description; and I shall be glad if collectors will pay attention to these obscure insects, and when possible collect good series of them from the same locality, to show the range of variation; any particulars of habit would also be useful. Possibly all may feed on species of rush (*Juncus*).

Bactra fœderata, n. sp.

♂. 20-22 mm. Head, thorax, and abdomen whitish-ochreous. Palpi 4, whitish-ochreous, second joint suffused with fuscous except towards margins. Forewings elongate, hardly dilated, costa moderately arched, apex round-pointed, termen sinuate, rather oblique ; whitish-ochreous, with scattered fuscous and blackish scales tending to form undefined strigulæ ; costa marked throughout with short oblique ochreous strigulæ irrorated with blackish ; an irregular spot of deep ochreous suffusion in disc at $\frac{1}{3}$, and a small blackish spot in disc beyond $\frac{2}{3}$ connected by a whitish streak, whose apex is bent up above second spot ; an elongate-triangular patch of ochreous-brown suffusion, more or less irrorated with dark fuscous, extending along costa from before middle to about $\frac{4}{5}$; a fine black terminal line not reaching apex or tornus : cilia whitish-ochreous. Hindwings and cilia whitish.

Maskeliya, Ceylon, in April and August (de Mowbray, Pole); two specimens.

Resembles a strongly marked specimen of *Epibactra arenosa*, but distinguished by structure, and more oblique termen of forewings.

Bactra sociata, n. sp.

♂ 17-18 mm., ♀ 21-23 mm. Head, thorax, and abdomen whitish-ochreous. Palpi in ♂ 3, in ♀ 3½, whitish-ochreous, second joint tinged with fuscous except towards margins. Forewings elongate, rather narrow, costa gently arched, apex round-pointed, termen sinuate, rather oblique ; whitish-ochreous, with indications of scattered fuscous strigulæ ; costa marked throughout with short oblique deep ochreous strigulæ irrorated with blackish ; outer edge of basal patch indicated by an indistinct deep ochreous obtusely angulated striga ; a white longitudinal streak in disc (obsolete in ♀) from this striga to beyond $\frac{2}{3}$, its extremity somewhat bent upwards between two dots of dark fuscous irroration ; an elongate-triangular patch of deep ochreous suffusion finely sprinkled with dark fuscous extending along costa from before middle to about $\frac{4}{5}$; an ochreous striga marked with four or five cloudy dots of blackish irroration near before lower part of termen ; a fine ochreous terminal line irrorated with black not reaching apex or tornus ; cilia pale ochreous, on termen infuscated towards tips. Hindwings pale whitish-fuscous ; cilia whitish-ochreous.

Maskeliya and Kelawewa, Ceylon, in May, July, September, and January (Pole, Alston) ; four specimens. Very like the preceding, but with shorter palpi, narrower forewings with costa less arched, discal streak terminated between two dots instead of above a spot, the striga before termen, and hindwings tinged with fuscous. These two species are quite distinct in appearance from all those which follow.

Bactra metriacma, n. sp.

♂♀. 16-19 mm. Head and thorax whitish-ochreous. Palpi 3-3½, ochreous-whitish, with broad oblique band of fuscous suffusion. Abdomen grey. Forewings elongate, rather narrow, posteriorly hardly dilated, costa gently arched, apex tolerably pointed, termen slightly sinuate, rather strongly oblique ; light brownish-ochreous, posteriorly ferruginous-tinged, more or less irregularly sprinkled with dark fuscous ; costa marked throughout with short strigulæ of blackish irroration, alternating with indistinct longer oblique whitish strigulæ mixed with leaden-grey ; a rather ill-defined white longitudinal streak above middle from base to apex, cut posteriorly by two or three dark veins, edged above by a suffused streak of black irroration towards base, and beneath by a short blackish streak in disc towards middle, terminated by a white projecting tooth from lower edge on transverse vein, and by a line of black irroration between this and apex ; beyond cell some dark lines on veins, and more or less whitish suffusion between veins posteriorly ; dorsum dotted or marked with blackish : cilia light brownish-ochreous sprinkled with dark fuscous, with rows of whitish points. Hindwings grey ; cilia grey-whitish, with grey subbasal line.

Maskeliya, Ceylon, from August to November (Green, Pole) ; seven specimens. At first sight much like *phenacistis*, but paler and more ochreous, and readily distinguished by the longer palpi, more pointed forewings, and more oblique termen.

Bactra copidotis, n. sp.

♂ ♀. 16-20 mm. Head and thorax whitish-ochreous tinged with brownish. Palpi $2\frac{3}{4}$, whitish-ochreous, more or less infuscated towards middle, base white beneath. Abdomen pale greyish-ochreous. Forewings elongate, rather narrow, especially in ♀, hardly dilated, costa gently arched, apex round-pointed, termen sinuate, oblique ; ferruginous-ochreous ; costa with numerous indistinct ochreous-whitish oblique strigulæ, alternating with short strigulæ of blackish irroration ; a very undefied streak of ochreous-whitish suffusion above middle from base to apex, cut by two or three dark veins posteriorly edged beneath throughout with broad more or less marked suffusion of dark fuscous irroration ; veins posteriorly beneath this more or less suffused with dark fuscous ; dorsum dotted with dark fuscous : cilia ferruginous-ochreous suffusedly irrorated with dark fuscous, and sprinkled with whitish, above apex and on costa white. Hindwings in ♂ grey, in ♀ whitish-grey ; cilia grey-whitish with two grey lines.

Gampola, Puttalam, and Maskeliya, Ceylon, in October, November and February (Pole, Green) ; Palni Hills, 6,000 feet (Campbell) ; five specimens. This species has the termen of forewings more distinctly sinuate than any other described, but only moderately oblique.

Bactra leucogama, n. sp.

♂ ♀. 13-15 mm. Head, palpi, and thorax whitish-ochreous ; palpi 2. Abdomen ochreous-whitish. Forewings elongate, rather narrow, hardly dilated, costa gently arched, apex obtuse, termen almost straight, oblique ; whitish-ochreous, mixed with silvery-metallic suffusion, which tends to form irregular transverse strigæ ; costa marked with short deep ochreous strigulæ irrorated with blackish, and about seven longer deep ochreous strigulæ ; deep ochreous markings as follows, *viz.*, a spot on suffusion in disc towards base, a transverse spot in disc at $\frac{1}{3}$, an irregular or interrupted fascia on dorsal $\frac{2}{3}$ beyond middle, combined in middle with an irregular sinuate streak running to apex, an oblique triangular prætornal spot, and a slender streak along termen ; dorsum with minute dots of blackish irroration : cilia whitish-ochreous mixed with deeper ochreous. Hindwings in ♂ pale grey, in ♀ whitish; cilia whitish in ♂ with faint grey subbasal line.

Puttalam, Ceylon, in February and August (Pole); four specimens. Recognisable by the pale ochreous colouring, distinct deeper ochreous markings, termen of forewings not sinuate, and white hindwings of ♀ (in ♂ paler grey than usual); but I have another apparently distinct undescribed species, in which the ♀ has also white hindwings.

Bactra honesta, n. sp.

♂ ♀. 14-16 mm. Head ochreous-whitish. Palpi 2, whitish, with broad median fuscous band. Thorax pale ochreous. Abdomen greyish. Forewings elongate, hardly dilated posteriorly, costa moderately arched, apex tolerably pointed, termen rather sinuate, oblique; pale ochreous, more or less tinged with ferruginous-brownish, especially towards disc beyond middle, with a few scattered dark fuscous scales; costa marked with long oblique ochreous-whitish strigulæ more or less tinged with leaden-grey, alternating with very slight short strigulæ of black irroration; between $\frac{1}{3}$ and apex the whitish strigulæ are often continued across wing as well-marked angulated striæ, leaving an angulated basal patch and narrow irregular central facia of ground colour; generally a more or less marked broad streak of blackish irroration in disc from base to end of cell, sometimes well-defined above and continued to near apex; often a subcrescentic downwards-curved dark spot in disc at $\frac{2}{3}$; space beyond cell variably mixed with whitish suffusion and irrorated with dark fuscous, with two distinct black interneural lines between veins 6-8, and indications of others, especially often two short black marks between veins 3-5: cilia pale brownish-ochreous with rows of whitish points, sometimes somewhat sprinkled with dark fuscous, at apex with a more or less marked dark ochreous-brown spot marked with black. Hindwings grey, paler towards base: cilia ochreous-whitish, with an indistinct grey subbasal line.

Khasis, from June to September; twenty specimens. Variable, but always without definite white longitudinal streak, though the dark suffusion marking its lower margin is often strongly expressed; forewings more pointed than usual, as in *Metriacma*, but termen less oblique than in that species, and palpi much shorter.

Bactra phenacistis, n. sp.

♂ ♀. 14-19 mm. Head whitish-ochreous, faintly brownish-tinged. Palpi $2\frac{1}{4}$, whitish-ochreous, with a more or less wide oblique median bar of dark fuscous suffusion. Thorax pale ochreous, sometimes brownish-tinged, with some dots of dark fuscous irroration. Abdomen whitish fuscous. Forewings elongate, rather narrow, slightly dilated posteriorly, costa gently arched, apex obtuse, termen faintly sinuate, oblique; pale ochreous, more or less tinged or suffused with ferruginous-brown, sometimes mixed or suffusedly strigulated with whitish on dorsal half; costa with about eight pairs of rather long oblique silvery-whitish strigulæ more or less mixed with leaden-grey, alternating with indistinct strigulæ of blackish irroration; a longitudinal whitish streak above middle from base to apex, cut obliquely by one or two dark veins posteriorly, and margined beneath by much blackish suffusion especially on veins, often with a distinct white projection downwards on transverse vein ; veins from cell posteriorly marked by lines of blackish suffusion ; dorsum dotted with black and white ; cilia grey somewhat mixed with ochreous-brownish, with rows of white and blackish points. Hindwings grey, rather darker towards apex ; cilia whitish grey, with two grey lines.

Maskeliya, Ceylon, from November to May (Pole, de Mowbray, Alston) ; seven specimens.

Bactra truculenta, n. sp.

♂. 15-17 mm. Head and thorax pale greyish-ochreous, somewhat mixed with fuscous on sides. Palpi 2, grey-whitish mixed with fuscous. Forewings elongate, rather narrow, posteriorly slightly dilated, costa gently arched, apex obtuse, termen straight, oblique ; whitish-ochreous suffusedly strigulated throughout with fuscous ; costa obliquely strigulated throughout with dark fuscous ; some irregular dark fuscous suffusion beneath middle of disc from about ¼ to ¾ ; a white discal dot at ⅔, preceded and followed by irregular longitudinal black marks ; veins beyond cell marked by fine dark fuscous lines ; two small blackish interneutral marks above tornus ; a small subtriangular subapical patch of dark fuscous suffusion, edged above with ochreous-white suffusion ; some black irroration along termen : cilia pale fuscous with rows of whitish points, indistinctly spotted with dark fuscous irroration. Hindwings grey ; cilia whitish grey, with grey subbasal line.

N. Coorg, 3,500 feet, in March (Newcome) ; two specimens.

Bactra minima, n. sp.

♂. 8-9 mm. Head and thorax pale whitish-ochreous, slightly tinged with brownish. Palpi 1⅔, ochreous-whitish, with median band of blackish irroration, abdomen pale greyish-ochreous. Forewings elongate, rather narrow, posteriorly slightly dilated, costa gently arched, apex obtuse, termen almost straight, oblique ; whitish ochreous slightly tinged with brownish, with scattered indistinct dark fuscous strigulæ ; costa strigulated with blackish ; undefined darker spots below middle at ⅓ and ⅔ indicated by ochreous-fuscous suffusion or dark fuscous irroration ; dorsum and termen dotted with blackish irroration : cilia pale whitish ochreous, towards apex sprinkled with blackish. Hindwings rather light grey ; cilia ochreous-whitish, with faint grey subbasal line.

Barberyn Island, Ceylon, in February (Fletcher); two specimens. Easily known by the unusually small size and short palpi.

Bactra tornastis, n. sp.

♂ ♀. 14-16 mm. Head and thorax whitish-ochreous, sometimes tinged with brownish. Palpi 2, whitish-ochreous, with broad median band of fuscous suffusion. Abdomen pale grey. Forewings elongate, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen in ♂ gently rounded, in ♀ nearly straight, oblique ; whitish-ochreous, more or less generally suffused with ferruginous-brownish, and sprinkled with dark fuscous ;

costal edge dark fuscous, marked throughout with rather long oblique ochreous-whitish strigulæ more or less suffused with leaden-grey ; an ochreous-whitish streak above middle from base to apex usually very incompletely defined, and cut posteriorly by dark lines on veins, margined beneath by a very broad dark fuscous suffused streak extending from base to $\frac{3}{4}$, with a white dot on transverse vein cutting upper edge of this suffusion, and a wedgeshaped mark of dark fuscous suffusion at apex ; veins beyond cell marked with streaks of dark fuscous suffusion ; dorsum dotted with dark fuscous suffusion : cilia fuscous, with rows of whitish and dark fuscous points. Hindwings light grey ; cilia whitish.

Nawalapita, Ceylon, in January (Pole) ; Gooty (Campbell) ; Coorg, 3,500 feet, in October (Newcome) ; four specimens. The only species which has the termen of forewings rounded in ♂ ; in all the rest it is straight or sinuate.

Polychrosis, Rag.

This is the genus hitherto passing as *Chrosis*, Gn. It differs from *Bactra* by the crested thorax, from *Proschistis* by 6 and 7 of hindwings being connate or stalked, from *Argyroploce* by the separation of 3 and 4 of hindwings. I have described one species, *ephippias*, and now give four more.

Polychrosis cerata, n. sp.

♂ ♀. 10-12 mm. Head and thorax pale yellow-ochreous. Palpi with long rough spreading scales, pale ochreous, more or less sprinkled with dark fuscous towards base. Abdomen rather dark grey. Forewings elongate, rather narrow, posteriorly slightly dilated, costa gently arched, apex obtuse, termen little rounded, somewhat oblique ; dark fuscous, with purplish-leaden reflections, with the base of all scales fuscous-whitish, forming fine transverse striæ ; costa with about six oblique blackish fuscous strigulæ, and sometimes mixed with yellowish between these ; base sometimes mixed with ochreous-yellowish ; large oblique irregular ochreous-yellow blotches from dorsum about $\frac{1}{4}$ and beyond middle, reaching half across wing , sometimes united with smaller less developed or nearly obsolete blotches from costa to form angulated fasciæ ; an angulated bluish-leaden striga from $\frac{4}{5}$ of costa to tornus, its margins sometimes more or less marked with ferruginous-yellowish : cilia fuscous mixed with dark fuscous and sprinkled with fuscous-whitish with a dark fuscous subbasal line. Hindwings fuscous ; cilia light fuscous, with a dark fuscous subbasal line.

Diyatalawa, Ceylon (Fletcher) ; Khasis, in August ; nine specimens.

Polychrosis fallax. n. sp.

♂ ♀. 15-17 mm. Head pale ochreous. Palpi pale ochreous, second joint with three small dark fuscous spots externally on upper margin, and one on lower margin near apex. Thorax pale brownish-ochreous, irregularly spotted with dark fuscous irroration. Abdomen fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen almost straight, little oblique ; pale brownish-ochreous, with scattered strigulæ of ochreous and blackish irroration ; basal patch mixed with ochreous and blackish, ill-defined, edge irregular ; space between this and central fascia with one or two irregular more or less marked leaden metallic strigæ ; central fascia broad throughout, little oblique deep brownish-ochreous or ferruginous-ochreous mixed with leaden-metallic and blackish, more strongly marked with blackish on upper half, appearing to form a blackish costal blotch attached anteriorly to a downwards-curved longitudinal mark in disc ; an ochreous streak sprinkled with blackish extending from posterior margin of central fascia near costa to middle of termen, space above and below this marked with irregular leaden-metallic strigæ ; costa posteriorly with three small blackish spots whence arise short brownish strigulæ meeting beneath apex : cilia brownish-ochreous mixed with leaden-grey and blackish with a subbasal blackish line, at tornus with a whitish-ochreous patch. Hindwings rather dark fuscous, in ♂ with dorsum clothed with expansible tuft of whitish ochreous hairs ; cilia fuscous, with dark fuscous subbasal line, in ♂ becoming whitish-ochreous towards dorsum.

Khasis, from July to September ; twelve specimens.

Polychrosis anceps, n. sp.

♂ ♀. 12-14 mm. Head and thorax pale ochreous mixed with fuscous. Palpi pale ochreous, indistinctly spotted with fuscous. Abdomen fuscous. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen faintly sinuate, hardly oblique ; pale brownish-ochreous, mixed with leaden grey, which tends to form irregular transverse striæ ; small blackish spots along costa ; basal patch irregularly mixed with brownish and black, outer edge irregular ; central fascia brownish, hardly oblique, very undefined towards costa broad and suffusedly mixed with blackish, in middle of disc with a longitudinal down-curved black mark, posterior edge excavated above and below this ; an erect elongate-triangular brownish prætornal spot edged by undefined blackish striæ continued upwards as a single stria $\frac{3}{4}$ across wing ; a brownish streak mixed with black from near extremity of this to termen below middle ; a small brownish apical spot : cilia fuscous, with blackish subbasal line, beneath tornus somewhat mixed with whitish-ochreous. Hindwings rather dark fuscous, darker posteriorly ; cilia fuscous, with dark fuscous subbasal line.

Puttalam, Ceylon, in April (Pole) ; two specimens.

Polychrosis gabina, n. sp.

♂ ♀. 14-15 mm. Head brown. Palpi brown, paler and ferruginous-tinged towards apex of second joint above. Thorax brown, more or less marked with blackish and sometimes spotted with white, crest suffused with ferruginous. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen nearly straight, vertical, rounded beneath ; bronzy-brownish, irregularly marked with black ; costa black, with pairs of whitish strigulæ ; anterior half of wing crossed by several irregular leaden-metallic striæ, sometimes partially edged with whitish ; two oblique leaden-metallic streaks from costa beyond middle more or less united with two very irregular thick partially white-edged leaden-metallic streaks from about tornus, forming margins of ocellus ; cilia metallic leaden-grey, with dark fuscous basal line.

Hind-wings dark fuscous, more blackish posteriorly; an elongate suffused hyaline patch from base beneath and along lower part of cell; in ♂ whole dorsal area formed into a large separate lobe by a deep incision extending beneath cell nearly to base; cilia grey-whitish, with dark fuscous basal line.

Khasis, from November to March: nine specimens. Veins 3 and 4 of hindwings are more widely remote in ♂ than in ♀, owing to wing-modification.

Proschistis, Meyr.

Differs from *Polychrosis* by veins 6 and 7 of hindwings being approximated towards base but separate, from *Argyroploce* by separation of veins 3 and 4 of hindwings. Founded on a single species; I now add three more.

Proschistis lucifera, n. sp.

♀. 23 mm. Head, palpi, and thorax fuscous mixed with darker, patagia mixed with yellowish. Abdomen light fuscous. Forewings elongate, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen nearly straight, little oblique; secondary cell moderately broad; fuscous mixed with blackish towards dorsum tinged with greenish on veins; costa suffused with blackish and marked with nine pairs of ochreous whitish strigulæ; basal patch mixed with whitish, hardly defined except by a blackish-fuscous dorsal spot at $\frac{1}{3}$, and followed by two pairs of very irregular whitish striæ; two similar pairs beyond middle, confluent in disc and crossed above middle by a narrow inwards-oblique pale yellow blotch; a pair of whitish striæ before termen, becoming double on lower half; some white dots on termen, edged anteriorly by a waved blackish line; cilia fuscous, indistinctly barred with pale yellowish. Hindwings fuscous; cilia light fuscous, sprinkled with whitish towards tips with a darker subbasal line.

Palni Hills (Campbell); one specimen.

Proschistis agitata, n. sp.

♂ ♀. 19-21 mm. Head and thorax pale reddish-fuscous mixed with dark fuscous and whitish. Antennal ciliations in ♂ short. Palpi brownish suffusedly mixed with dark fuscous. Abdomen grey, in ♂ suffused with whitish ochreous towards base. Forewings elongate, posteriorly somewhat dilated, costa gently arched, apex obtuse, termen slightly sinuate, hardly oblique; secondary cell very narrow; fuscous tinged with reddish, and irregularly mixed with white, and strigulated with black; outer edge of basal patch indicated by a small black spot on costa; central fascia formed by blackish suffusion, narrow, irregular, indistinct, below middle forming a more conspicuous very irregular elongate blotch; a rather narrow fascia of blackish suffusion from costa before apex to dorsum before tornus, marked on veins with brown: cilia fuscous mixed with dark fuscous, on tornus sprinkled with whitish. Hindwings fuscous, darker towards apex; cilia fuscous, with dark fuscous subbasal line.

Maskeliya and Patipola, Ceylon, in February and October (Alston, de Mowbray); four specimens. The secondary cell of forewings is in *P. zalenta*, still narrower than in this species, a point not noticed in my description.

Proschistis invida, n. sp.

♂ ♀. 14-16 mm. Head light fuscous. Palpi fuscous-whitish, suffusedly spotted with fuscous. Thorax fuscous sprinkled with whitish, and suffusedly spotted with darker fuscous. Abdomen fuscous. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen faintly sinuate, little oblique ; ochreous-brownish ; costal edge suffused with blackish, and marked with eight or nine pairs of oblique whitish strigulæ ; basal patch mixed with black and leaden-metallic, outer edge rounded ; space between this and central fascia mostly occupied by two irregular leaden-metallic striæ edged with whitish ; central fascia moderate, mixed with black, posterior edge irregular, with long subcostal and median projections, excavation filled with leaden-metallic ; beyond this a thick double partially whitish-edged leaden-metallic stria, separating into two thick branches to enclose an elongate-triangular prætornal spot mixed with black ; leaden-metallic lines from last three pairs of costal strigulæ converging to a point beneath apex, space between this and preceding stria longitudinally streaked with black suffusion except towards costa : cilia rather dark fuscous, finely sprinkled with whitish points. Hindwings dark fuscous ; cilia fuscous, with darker subbasal line.

Khasis, in September ; four specimens.

Asaphistis, n. g.

Antennæ in ♂ strongly fasciculate-ciliated. Palpi moderate, porrected, second joint triangularly rough-scaled, terminal joint short. Forewings with 8 and 9 stalked. Hindwings with 3 and 4 remote, 3 from well before angle, 5 approximated to 4 at base, 6 and 7 approximated towards base. (Thorax probably crested, but damaged.)

Allied to *Proschistis*.

Asaphistis præceps, n. sp.

♂. 15-16 mm. Head and palpi fuscous mixed with black. Thorax pale whitish-ochreous, anterior margin fuscous mixed with black. Abdomen grey. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen faintly sinuate, little oblique ; white ; basal patch dark fuscous mixed with blackish, somewhat marked with whitish towards dorsum, outer edge irregular, nearly straight, vertical ; central fascia represented by a small dark fuscous spot on costa, and a dark fuscous dorsal blotch not reaching half across wing but connected with basal patch by irregular dark fuscous suffusion ; some irregular ochreous-fuscous marking in disc beyond middle, and an oval patch of ochreous-fuscous suffusion above tornus ; a small dark fuscous costal spot before central fascia and four beyond it, last two absorbed in a triangular dark fuscous apical blotch which extends along termen to below middle, more or less dotted with white on termen : cilia fuscous spotted with dark fuscous and white, at termen with a whitish patch. Hindwings grey ; cilia light grey.

Khasis, in September ; two specimens.

Articolla, Meyr.

The following species agrees well in structure with the one described.

Articolla prospera, n. sp.

♀. 17 mm. Head light brownish-ochreous tinged with fuscous. Palpi dark fuscous, second joint with light ferruginous-ochreous median band, apex of terminal joint pale ochreous. Thorax light brownish-ochreous mixed with dark fuscous. Abdomen dark fuscous. Forewings elongate, posteriorly dilated, costa slightly arched, sinuate in middle, costal cilia prominent beyond sinuation, apex obtuse, termen straight, somewhat oblique; ferruginous brown mixed or reticulated with dark fuscous; costa shortly strigulated with dark fuscous and ochreous-whitish; a moderate very oblique leaden striga from costa at $\frac{1}{3}$; an elongate-triangular blackish costal spot beyond middle; four leaden strigæ from costa posteriorly, first running to termen beneath apex edged beneath with ochreous-whitish, other three short, costa between these ferruginous, apical edge also leaden; a group of four roundish partly confluent whitish-ochreous spots between these markings and tornus, more or less brownish-tinged except on margins, especially the two lower which are mostly filled with ochreous-brown suffusion and leaden-grey irroration: cilia pale brownish-ochreous, with ferruginous basal shade round apex. Hindwings dark fuscous, bases of scales subhyaline, appearing finely striated; cilia pale fuscous, with darker basal shape.

Khasis, in June; one specimen.

Statherotis, n. g.

Antennæ in ♂ shortly ciliated. Palpi moderate, porrected, second joint rough-scaled above and beneath. Thorax with posterior crest. Forewings with 8 and 9 stalked. Hindwings with 3 and 4 connate, 5 approximated, 6 and 7 approximated towards base.

Statherotis decorata, n. sp.

♂. 18 mm. Head pale greyish-ochreous somewhat mixed with blackish. Palpi whitish-ochreous, suffused with fuscous except towards base and apex. Thorax whitish-ochreous, anteriorly tinged with brownish and marked with blackish-grey. Abdomen fuscous, basal third ochreous-yellowish, apex whitish-ochreous. Posterior tibiæ beneath with long projecting ochreous scale, forming a broad triangular tuft before middle and grey expansible hair-pencil from base lying on inner side of this. Forewings elongate, moderate, posteriorly dilated, costa gently arched, apex obtuse, termen somewhat sinuate, vertical, rounded beneath; rather dark brown tinged with reddish, mixed with blackish and suffusedly striated with ashy-grey; a large semi-oval ochreous-whitish blotch extending along costa from $\frac{1}{3}$ to $\frac{2}{3}$ and reaching nearly half across wing, marked with indistinct pale red-brownish oblique strigulæ becoming distinct and blackish on costa, and a light brownish oblique costal spot in middle; and ashy-grey fascia indistinctly edged with whitish from beyond this blotch in disc to $\frac{3}{4}$ of dorsum, followed by some undefined whitish suffusion towards termen: cilia pale fuscous sprinkled with whitish, with two dark grey shades. Hindwings dark fuscous, with bases of scales subhyaline, appearing finely striated; a large patch of rather thinly strewn modified black hairscales with prismatic green and purple reflections occupying whole of disc from near base to $\frac{3}{4}$; whole dorsal area beneath this yellow-ochreous, towards dorsum clothed with long dense scales and with dorsal cilia elongated, on lower surface with expansible long hairs in a subdorsal groove; cilia as in forewings, becoming ochreous round dorsal patch.

Maskeliya, Ceylon, in April (Pole); one specimen. The special colouring and structures of hindwings will doubtless prove to be confined to the ♂.

Argyroploce, Hb.

I agree with Prof. Fernald in adopting this name for the genus previously termed by me *Eucosma*, Hb. (that name being rightly applied otherwise), including also *Platypeplus*, as previously explained. I find further that the stalking of veins 3 and 4 of hindwings cannot be properly used to distinguish *Enarmonia* generically, since in some of the species hereafter described the structure is inconstant within the limits of the same species, and I propose therefore to rely on the thoracic crest to separate the two genera, attributing all those species with well-developed crest to *Argyroploce*; on this view the four Indian species already referred to *Enarmonia* must all be transferred to *Argyroploce*. On this understanding the number of Indian species already described which are attributable to *Argyroploce* is 28, and I now describe 33 more, and have still much additional material.

Argyroploce lasiandra, n. sp.

♂. 21 mm. Head, palpi, and thorax rather dark fuscous, palpi porrected. Abdomen light greyish-ochreous, dorsally clothed with dense rough hairs, and with large expansible anal tuft. Posterior tibiæ and basal joint of tarsi clothed with dense long rough greyish-ochreous scales above. Forewings moderate, posteriorly dilated, costa gently arched, apex obtuse, termen slightly rounded, oblique; dark grey, strigulated with blackish, tips of scales fuscous-whitish; cilia concolorous. Hindwings reduced, narrower than forewings, dorsal area folded and clothed with dense long hairs, tornus distorted and tufted with long projecting scales; fuscous, somewhat suffused with light brownish-ochreous in and beneath disc; cilia pale greyish-ochreous, with suffused fuscous subbasal shade.

Trincomali, Ceylon, in November (Green): one specimen.

Argyroploce tonsoria, n. sp.

♂. 16 mm. Head, palpi, and thorax pale brownish-ochreous irregularly sprinkled with dark fuscous, palpi subascending. Abdomen grey, apex rosy-tinged. Posterior tibiæ and basal joint of tarsi densely tufted above with long expansible whitish hairs. Forewings moderately elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen rounded, little oblique; brownish-ochreous suffused with ochreous-whitish; basal third irregularly mixed with yellow-brown and sprinkled with black; a yellow-brown triangular patch extending on costa from middle to near apex, its apex nearly reaching dorsum beyond middle, much mixed with black posteriorly, costal edge marked with five pairs of white strigulæ; a yellow-brown streak along upper part of termen, confluent above with triangular patch, preceded above middle by a triangular spot of blackish suffusion: cilia yellow-brown sprinkled with ochreous-whitish, on upper part of termen indistinctly barred with blackish. Hindwings rather dark fuscous; dorsal area somewhat dilated and clothed with hairs; cilia ochreous-whitish tinged with a brownish subbasal line.

Bentota, Ceylon; one specimen, bred in January from larva feeding in fruit of *Barringtonia racemosa* (Green).

Argyroploce oedalea, n. sp.

♂ ♀. 19-20 mm. Head and thorax whitish-ochreous more or less tinged or mixed with red-brownish. Palpi ascending, white, more or less tinged or mixed with red-brownish except towards base, in ♂ very slightly. Abdomen in ♂ dark brown, in ♀ dark grey. Posterior femora and basal half of tibiæ in ♂ with long fine expansible white hairs beneath. Forewings elongate, posteriorly dilated, costa slightly sinuate in middle, rather abruptly arched posteriorly, apex obtuse, termen nearly straight, hardly oblique, rounded beneath; in ♂ brownish-ochreous, in ♀ red-brownish, more or less strewn with scattered black scales: costa spotted and strigulated with black; several black strigulæ towards costa before middle: a cloudy streak of whitish-ochreous suffusion running beneath posterior part of costa and before upper portion of termen, margining an undefined posterior discal patch sometimes irregularly mixed with black and dark leaden, containing a tuft of long raised white and pale brown scales on transverse vein, more elongated in ♂; several minute black dashes in the whitish-ochreous streak towards costa posteriorly; sometimes some short dark blue-leaden marks beneath costa posteriorly and a line almost on apical edge; series of more or less marked black strigulæ on and before termen: cilia whitish-ochreous, with two brownish shades and indications of darker bars. Hindwings dark grey; cilia grey-whitish, with dark grey subbasal and light fuscous subapical shades.

Kandy and Peradeniya, Ceylon, from July to September (Green): three specimens. Specially characterised by the discal tuft of scales.

Argyroploce diserta, n. sp.

♂ ♀. 24-25 mm. Head red-brownish, mixed with dark fuscous and white, lower half of face white. Palpi ascending, brownish mixed with dark fuscous, banded with white. Thorax dark fuscous mixed with white. Abdomen fuscous, and tuft of ♂ whitish-ochreous. Posterior tibiæ clothed with long rough white hairs above and beneath, longer in ♂. Forewings elongate-triangular, costa rather abruptly bent at $\frac{2}{3}$, apex obtuse, termen almost straight, nearly vertical, rounded beneath; light reddish-brown, densely mixed and strigulated throughout with blackish; disc irregularly mixed with white on basal half; a transverse series of three roundish leaden-grey spots irregularly edged and connected with white, extending from near costa at $\frac{2}{3}$ to near tornus; a blue-leaden almost marginal interrupted line round apex and termen: cilia leaden-grey, basal half light brown-reddish, suffusedly barred with blackish. Hindwing dark fuscous; cilia whitish-fuscous, with two dark fuscous shades.

Khasis, in September: two specimens.

Argyroploce astrosema, n. sp.

♂ ♀. 20-21 mm. Head and thorax ochreous, upper half of face deep ferruginous, sides of thoracic crest ferruginous. Palpi ascending, ochreous, suffused above with deep ferruginous. Abdomen fuscous, apex in ♂ whitish-ochreous, in ♀ ferruginous-ochreous. Posterior tibiæ clothed with rough scales, in ♂ with expansible ochreous-whitish hair-pencil from base above. Forewings elongate-triangular, costa strongly and evenly arched, apex obtuse, termen in ♂ almost straight, in ♀ somewhat sinuate, vertical, rounded beneath; ochreous, irregularly suffused with ferruginous, with an undefined pale fascia from $\frac{3}{5}$ of costa to termen above tornus; basal half, posterior fascia, and centre of disc between these strewn irregularly with small bright silvery-leaden-metallic spots or strigulæ; a blackish discal dot beyond middle; an apical patch of blackish suffusion, cut by a silvery-blue-metallic streak crossing apex and continued along upper part of termen; white marginal dots above and below apex: cilia light ochreous, on upper half of termen and round apex dark leaden-grey with blackish subbasal line. Hindwings dark fuscous: cilia pale ochreous tinged with reddish, with fuscous subbasal line.

Khasis, in June; two specimens.

Argyroploce generosa, n. sp.

♂ ♀. 15-16 mm. Head fuscous, face whitish. Palpi ascending, whitish. Thorax fuscous mixed with white, crest dark brown. Abdomen pale ochreous, in ♀ somewhat infuscated. Posterior tibiæ smooth-scaled. Forewings elongate-triangular, costa moderately and evenly arched, apex obtuse, termen almost straight, hardly oblique, rounded beneath; grey; basal patch suffused with yellow-brown on upper half, marked with a suffused white streak along fold, beneath this somewhat mixed with black and suffused with darker grey, outer edge rather irregular; central fascia rather narrow irregular, yellow-brown, cut by a strong black bar in middle, and a narrow one beneath this, posterior edge with abrupt projections above and below upper bar: apical area beyond upper half of central fascia and a line connecting it with tornus white, except an irregular grey streak from costa beyond central fascia to tornus, more or less broken, into three spots, a small brown costal spot beyond this, three yellow-brown marks from costa before apex converging to termen beneath apex and suffused together with grey, and an upwards-oblique mark from middle of termen marked with three black spots: cilia grey sprinkled with white, indistinctly barred with yellow brownish, towards tornus suffused with whitish. Hindwings pale yellow-ochreous, infuscated in ♂ towards apex, in ♀ generally: cilia pale yellow-ochreous, with a more or less distinct fuscous shade.

Khasis, in June; three specimens.

Argyroploce charadræa, n. sp.

♂ ♀. 18-21 mm. Head dark grey, mixed on crown with white and on forehead with red-brownish. Palpi ascending, reddish-fuscous mixed with dark fuscous. Thorax white mixed with dark fuscous, crest ferruginous-brownish. Abdomen grey, anal tuft in ♂ whitish-ochreous. Posterior tibiæ rather densely scaled, in ♂ with whitish-ochreous hair-pencil from base above. Forewings elongate, rather narrow, posteriorly dilated, costa slightly arched, apex obtuse, termen nearly straight, rather oblique; bluish-leaden-grey mixed and strigulated with black, anterior area from base to before middle of costa and beyond middle of dorsum much suffused with irregular whitish except along costa, so that the dark colour appears as a coarse strigulation: a white patch occupying apical fourth of wing, its edge extending from $\frac{3}{4}$ of costa to dorsum before tornus, upper half sending an oblique triangular projection downwards to fold; a small ochreous-brownish mark on costa before apex, and another at apex sometimes containing a black dot; a cloudy grey striga before termen, terminating in a small brownish spot on termen above tornus: cilia grey irrorated with white, with indications of blackish lines, towards tornus wholly whitish. Hindwings grey with a slight bronzy tinge; cilia whitish-grey, with grey subbasal shade.

Maskeliya and Patipola, Ceylon, in April and May (Alston, Pole); three specimens.

Argyroploce citharistis, n. sp.

♂ ♀. 11-14 mm. Head brown, sometimes mixed with paler or darker. Palpi porrected, brownish, mixed in middle with dark fuscous, towards base whitish. Thorax brown mixed with dark fuscous, with a transverse median, band of whitish irroration or suffusion. Abdomen fuscous, in ♀ darker. Posterior tibiæ with appressed scales. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen almost straight, rather oblique; dark bronzy-fuscous, strigulated with blackish; anterior half crossed by four pairs of irregular blue-leaden striæ rising from short whitish costal strigulæ, two posterior pairs sometimes partially whitish-edged: costa spotted with blackish-fuscous between these, and with a larger oblique spot in middle indicating central fascia; an irregular thick blue-leaden transverse stria beyond this, furcate on costa: between this and apical spot two pairs of white striæ variably developed, sometimes partially obsolete, sometimes united into a broad white fascia, including a thick irregular blue-leaden mark from tornus reaching half across wing, and a thick upwards-oblique dark fuscous streak from middle of termen; a triangular apical spot of ferruginous-brown scales with dark fuscous tips, preceded by a leaden-metallic streak: cilia leaden-grey with blackish basal line, and indications of blackish bars. Hindwings with 6 and 7 stalked; fuscous, suffused with darker towards termen: cilia light fuscous, with dark fuscous subbasal shade.

N. Coorg, 3,500 feet (Newcome); Khasis; Moulmein, Burma; from June to November and in February; twelve specimens. The stalking of veins 6 and 7 of hindwings is exceptional in the genus, but in all other respects the species seems to belong here.

Argyroploce palliata, n. sp.

♂ ♀. 17-18 mm. Head whitish, forehead fuscous or dark grey, with violet reflections. Palpi subascending, fuscous with violet reflections, beneath ochreous-whitish. Thorax whitish, spotted with dark grey. Abdomen light fuscous. Posterior tibiæ with appressed scales. Forewings elongate-triangular, costa gently arched, apex obtuse, termen almost straight, somewhat oblique ; dark fuscous ; a whitish basal patch occupying $\frac{2}{5}$ of wing, irregularly spotted with grey except towards dorsum posteriorly, outer edge nearly straight or sometimes angularly projecting near costa, vertical ; a fascia of irregular leaden-metallic striæ beyond middle, angulated near costa, somewhat marked with white towards dorsum ; two irregular subconfluent white striæ before termen, marked with leaden-metallic streaks on veins, lower portion broken inwards above middle : cilia rather dark fuscous sprinkled with white, towards base whitish barred with fuscous. Hindwings fuscous ; cilia fuscous sprinkled with whitish, base pale.

Khasis, in June, September, and October : four specimens.

Argyroploce corthyntis, n. sp.

♂ ♀. 19-21 mm. Head and thorax varying from light brownish-ochreous or grey to rather dark fuscous. Palpi porrected grey, suffused with white towards base beneath and on upper edge of second joint. Abdomen light brownish-ochreous, sometimes mixed with dark fuscous. Posterior tibiæ rough scaled. Forewings elongate, narrow at base, considerably dilated posteriorly, costa slightly arched, with an abruptly rounded prominence from middle to near apex, apex prominent, round-pointed, termen rather strongly sinuate beneath it, vertical, rounded beneath ; pale grey, brownish-ochreous, or whitish-fuscous, sometimes sprinkled with fuscous, or more or less wholly suffused with dark ashy-fuscous : costa shortly strigulated with black and dark brown, tending to form a small semi-oval spot in middle ; sometimes some blackish strigulæ in disc before middle ; apex usually ferruginous-brown marked with dark fuscous, sometimes preceded by two or three leaden strigulæ : dorsum sometimes dotted with blackish or whitish ; usually a fine black terminal line : cilia light brownish-ochreous, towards base usually markedly paler or grey-whitish. Hindwings light fuscous-ochreous, towards apex suffused with fuscous, in the darkest specimen mostly suffused with rather dark fuscous : cilia light ochreous, with fuscous subbasal shade.

Patipola and Hakgala, Ceylon, in April and May (Green, Alston, Pole) ; six specimens. Nearly allied to *lichenoides*, Wals., which is the type of the genus *Lipsotelus*, Wals., but I do not regard the peculiar form of forewings, which is the main distinguishing character, as deserving generic separation. In *lichenoides*, which I possess from the Khasi Hills, the costal prominence of forewings does not extend so far towards apex, and the apex is less prominent.

Argyroploce caryactis, n. sp.

♂ ♀. 14-15 mm. Head, palpi, and thorax ferruginous or ferruginous-brown, palpi porrected. Abdomen dark fuscous, apex in ♂ grey-whitish, at base in ♂ with an expansible lateral whitish hair-pencil. Posterior tibiæ with appressed scales. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen slightly sinuate, hardly oblique; bright coppery-ferruginous, the ground colour mostly overlaid by suffused confluent light violet-grey striæ; a broad undefined streak of dark ferruginous-brown suffusion along dorsum, including in middle an undefined elongate-triangular patch of pale grey strigulation, sometimes sprinkled with blackish: cilia ferruginous-brown, mixed with whitish-ochreous and sometimes pale leaden-grey, towards tips whitish on a subapical patch. Hindwings on basal half dark fuscous, thinly scaled, outer half blackish-fuscous; in ♂ with dorsal groove clothed with long pale ochreous and whitish hairs; cilia white, with dark fuscous basal shade.

Khasis, from December to March; sixteen specimens.

Argyroploce fibrata, n. sp.

♂ ♀. 16-18 mm. Head whitish-ochreous, forehead and sides of crown suffused with red-brown. Palpi porrected, pale ochreous sprinkled centrally with reddish-fuscous, beneath whitish. Thorax pale ochreous suffused with red-brown and sprinkled with blackish, patagia suffused with ochreous-whitish towards tips. Abdomen fuscous, anal tuft of ♂ mixed with ochreous-whitish. Posterior tibiæ and first joint of tarsi in ♂ clothed above with dense long expansible whitish hairs. Forewings elongate-triangular, costa moderately arched, apex obtuse, termen nearly straight, somewhat oblique; red-brown, sprinkled with blackish, tending to form longitudinal streaks on veins, dorsal third especially strongly streaked with black suffusion and more or less mixed with white between the streaks: extreme costal edge white, with more or less marked pairs of oblique whitish strigulæ, interspaces more or less irrorated with blackish: oblique bluish leaden strigæ rising from these, with indications of transverse striæ on posterior portion of wing, and transverse streaks margining ocellus, but all these sometimes almost wholly obsolete: cilia whitish-ochreous suffused with red-brown, more or less barred with blackish irroration. Hindwings dark grey, in ♂ with dorsal fold enclosing an expansible pencil of long blackish hairs becoming yellowish towards base; cilia whitish, with grey subbasal line.

Khasis, in September and October: four specimens.

Argyroploce metactenis, n. sp.

♂. 19 mm. Head whitish-ochreous, on crown more or less suffused with ferruginous-brown. Palpi subascending, fuscous sprinkled with whitish, beneath and towards base whitish, second joint with median bar and subbasal dot of blackish suffusion. Thorax light brownish, crest suffused with ferruginous. Abdomen rather dark fuscous, anal tuft mixed with whitish-ochreous. Posterior tibiæ and tarsi tufted with long expansible ochreous-whitish and grey hairs above. Forewings elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen nearly straight, little oblique; brownish, longitudinally striated and largely suffused with brown-whitish: veins in disc more or less marked with brown-reddish; costa strigulated with reddish-fuscous and black irroration: two or three very oblique dull reddish strigæ beneath costa posteriorly ; a transverse mark of dull reddish suffusion with some black irroration on end of cell ; a rather broad reddish-fuscous streak mixed with dark fuscous along dorsum throughout, upper edge somewhat prominent before middle and at $\frac{2}{3}$: cilia brown whitish towards tornus tinged with brown-reddish, on middle of termen with three reddish-brown bars sprinkled with blackish. Hindwings dark fuscous, lighter anteriorly ; a hyaline lanceolate spot beneath base of cell ; a longitudinal pecten of whitish hairs between veins 2 and 3 ; a dorsal furrow clothed with long expansible tuft of fuscous hairs ; cilia whitish, with dark fuscous subbasal line.

Khasis, in October and November ; two specimens.

Argyroploce paragramma, n. sp.

♀. 19 mm. Head, palpi, and thorax brownish-ochreous ; palpi subascending, second joint with a blackish median spot above ; thorax partly tinged with grey. Abdomen dark grey. Posterior tibiæ rough-scaled. Forewings elongate, moderately broad, rather dilated posteriorly, costa moderately arched, apex obtuse, termen slightly sinuate, hardly oblique ; brownish-ochreous, tending to be longitudinally marked with pale or ochreous-whitish lines on veins and some blackish irroration between these ; costa strigulated with ochreous-whitish tinged with leaden, with blackish interspaces ; three very oblique bluish-leaden strigæ from median third of costa, first two ending above posterior portion of cell, third running almost to termen beneath apex ; a leaden-metallic almost marginal striga along lower half of termen : cilia pale ochreous, above middle of termen tinged with brownish, above apex with a blackish spot. Hindwings dark fuscous, lighter anteriorly ; cilia ochreous-whitish tinged with grey, with dark fuscous subbasal line.

Pusa, Bengal, bred in September from stem of bamboo (Lefroy) ; one specimen.

Argyroploce anaplecta, n. sp.

♂ ♀. 15-16 mm. Head, palpi, thorax and abdomen dark fuscous ; palpi porrected, beneath and towards base white ; anal tuft of ♂ whitish. Posterior tibiæ of ♂ clothed above and beneath with dense (probably expansible) white scales. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen straight, vertical ; blackish-fuscous, suffusedly striated with purplish-leaden (more purplish in ♀), except a thick streak from $\frac{1}{4}$ of costa to middle of termen, and another slightly curved from middle of costa to apex ; costal extremities of striæ whitish, space between these in ♀ tinged with bronzy-brown towards costa ; ocellus filled with ground colour sprinkled with whitish ; two or three white specks on termen beneath apex : cilia dark fuscous. Hindwings dark fuscous, in ♂ thinly scaled and subopaque except towards apex ; cilia whitish-fuscous, with dark fuscous subbasal shade.

Maskeliya, Ceylon, in February, May and June (Pole, de Mowbray) ; three specimens.

Argyroploce cyanura, n. sp.

♂ ♀. 18-20 mm. Head and thorax dark leaden-fuscous. Palpi porrected, fuscous, suffused with dark fuscous towards apex and on a median bar, ochreous-whitish towards base beneath. Abdomen dark fuscous, in ♂ with dark blue or indigo patch before whitish apex. Posterior tibiæ in ♂ with appressed scales. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen almost straight, nearly vertical ; very dark fuscous ; basal patch formed of suffused purplish-leaden striæ, outer edge angulated in middle, angle confluent with corner of a similar quadrate dorsal blotch beyond it ; seven pairs of whitish costal strigulæ between $\frac{1}{3}$ and apex, first two giving rise to a whitish streak which soon becomes light brown and is curved round above middle of disc almost to costa at $\frac{3}{4}$, enclosed space suffused with light ferruginous-brown and marked with two or three oblique leaden lines ; sides of ocellus marked by triangular patches of suffused purplish leaden strigæ ; two or three white specks on termen beneath apex : cilia dark fuscous. Hindwings dark fuscous, lighter anteriorly ; cilia fuscous, with dark fuscous subbasal shade.

Khasis ; Gunong Ijan, Malay Peninsula ; in June and September ; five specimens.

Argyroploce aspidias, n. sp.

♂ ♀. 17-18 mm. Head ochreous-grey, forehead and sides of crown mixed or suffused with dark fuscous, face grey-whitish. Palpi subascending, fuscous suffused with dark fuscous towards apex, ochreous-whitish beneath and towards base. Thorax leaden-grey tinged with rosy and mixed with blackish. Abdomen dark fuscous. Posterior tibiæ in ♂ clothed beneath with large expansible brush of whitish hairs. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen somewhat rounded, little oblique ; blackish ; basal patch spotted with leaden-metallic, sometimes somewhat mixed with whitish, outer edge oblique ; seven pairs of whitish costal strigulæ between $\frac{1}{3}$ and apex, first two pairs giving rise to a rather broad ochreous-whitish streak passing above middle of disc and recurved to beneath costa at $\frac{2}{3}$, included costal spot more or less mixed with brownish-ochreous ; remaining pairs give rise to short fine leaden-metallic strigæ ; sides of ocellus marked by triangular patches of leaden-metallic spots ; two or three leaden-metallic marks towards termen beneath apex : cilia rather dark fuscous, with darker subbasal shade, base whitish. Hindwings dark fuscous ; cilia as in forewings.

Khasis, in August and September ; four specimens.

Argyroploce hyalitis, n. sp.

♂ ♀. 15-18 mm. Head and thorax dark fuscous irrorated with yellow-ochreous, appearing brownish. Palpi porrected, base whitish-ochreous, second joint grey with yellowish median band, terminal joint rather long, violet-grey. Abdomen dark fuscous, segmental margins bronzy. Posterior tibiæ smooth-scaled. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen rounded, rather oblique ; dark fuscous finely irrorated with pale ochreous with indications of darker striæ ; costa with about eight pairs of pale strigulæ, those on posterior half more distinct, beyond middle giving rise to two very oblique dark violet-leaden streaks, first reaching ⅓ across wing, second to near termen beneath apex ; ocellus more or less suffused with ochreous irroration, margined laterally by two dark violet-leaden streaks, and containing a series of about four short black dashes ; a pale ochreous almost marginal line crossing apex : cilia fuscous, with a black basal line. Hindwings subhyaline, pale fuscous, with a narrow-lanceolate clear hyaline streak beneath cell, veins blackish-fuscous ; a broad suffused blackish-fuscous terminal band ; cilia white, basal third blackish.

Khasis, in June and July ; sixteen specimens.

Argyroploce herbosa, n. sp.

♂ ♀. 13-15 mm. Head and thorax ochreous-whitish, more or less tinged with greenish. Palpi porrected, ochreous-whitish, second joint spotted with blackish. Abdomen dark grey. Posterior tibiæ with appressed scales. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen straight, vertical, rounded beneath ; dull yellowish-green ; a cloudy whitish line from base beneath submedian fold, sinuate downwards in middle, and continued to middle of termen, dorsal area beneath this more or less striated or suffused with whitish except towards base of dorsum and on a triangular tornal patch representing ocellus, above which are two or three black dashes ; costa black obliquely strigulated with white : sometimes an irregular black blotch representing upper third of central fascia, narrow on costa, with an irregular black streak projecting from it posteriorly, and more or less black suffusion preceding it, but these markings are sometimes wholly obsolete ; a short whitish longitudinal strigula resting on termen beneath apex ; cilia ochreous-whitish, sometimes with a grey subbasal line, and one or two dots of grey suffusion. Hindwings in ♂ beneath thickened along anterior half of costa with short dense rough scales, longest towards base ; dark fuscous, more blackish posteriorly ; cilia grey, towards tips whitish, with dark fuscous subbasal line.

Khasis, in June, October, and November ; four specimens.

Argyroploce claviculata, n. sp.

♂ ♀. 12-14 mm. Head and thorax varying from greyish-ochreous to ferruginous-brown, sometimes mixed with dark fuscous. Palpi porrected whitish, sometimes tinged with ferruginous, variably spotted with dark fuscous. Abdomen dark fuscous. Posterior tibiæ with tolerably appressed scales. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen slightly rounded, vertical ; varying from ferruginous-brownish to rather dark fuscous ; costa black obliquely strigulated with white ; costal half of wing from base to central fascia often suffused with blackish, especially in ♂, more or less indistinctly striated transversely with leaden-metallic ; dorsal area beneath this sometimes striated with whitish ; upper portion of central fascia usually forming a large trapezoidal blackish blotch, narrow on costa, issuing a long irregular projection posteriorly above ocellus, in ♂ often little defined ;

ocellus narrow, margined anteriorly by two oblique subconfluent thick leaden metallic streaks, and posteriorly by a broad irregular leaden-metallic streak, and crossed by several longitudinal black dashes, but all these are sometimes very indistinct; an oblique leaden-metallic striga beneath posterior half of costa, in ♂ sometimes obscured with blackish suffusion; a white longitudinal strigula touching termen beneath apex: cilia varying from whitish-ochreous to ferruginous-brownish, with a more or less marked blackish subbasal line, often with two or three patches of blackish suffusion. Hindwings rather dark fuscous, thinly scaled anteriorly, suffused with blackish-fuscous posteriorly; cilia grey, more whitish towards tips, sometimes reddish-tinged round apex, with dark fuscous subbasal line.

Khasis, from December to March; ten specimens.

Argyroploce acrosema, n. sp.

♂. 23-24 mm. Head brownish-ochreous, crown suffused with brown or crimson fuscous. Palpi porrected, whitish-ochreous suffused with grey or brownish except towards base. Thorax brown mixed with dark fuscous and ferruginous. Abdomen rather dark fuscous. Posterior tibiæ clothed with dense tolerably appressed scales. Forewings elongate, rather dilated posteriorly, costa gently arched, apex obtuse, termen almost straight, somewhat oblique, rounded beneath; light brownish or ochreous-grey strigulated with darker: a blackish blotch extending along costa from base to apex, its lower edge running along fold from base to beyond middle, thence in a straight line to apex, costa marked with pairs of whitish strigulæ, in one specimen giving rise to oblique leaden-metallic streaks whose interspaces are red-brown towards costa between $\frac{1}{4}$ and $\frac{3}{4}$; margins of ocellus indicated by thick leaden-metallic streaks, between which is a quadrate dark fuscous tornal spot; space above ocellus more or less suffused with brownish ochreous or dark red-brown, with a dark fuscous spot on middle of termen and longitudinal mark before it: a white subtriangular spot or linear mark at apex; a black terminal line: cilia dark leaden grey sometimes mixed with red-brown, with a clear whitish apical patch. Hindwings with 3 and 4 stalked or connate; dorsum clothed with long hairs; dark fuscous; cilia whitish-grey, with fuscous basal shade.

Khasis, in June; two specimens. Allied to the group of *orophias.*

Argyroploce halantha, n. sp.

♂ ♀. 16-18 mm. Head brown. Palpi ascending, white, with violet-blue reflections, base dark fuscous. Thorax dark brown mixed with whitish, crest pale ferruginous posteriorly. Abdomen dark fuscous. Anterior tarsi thickened with scales, white ringed with black; posterior tibiæ with appressed scales. Forewings elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, termen rather abruptly sinuate, little oblique; 3 much curved, 3-5 approximated posteriorly; brown, irregularly spotted and marked with black, basal, dorsal, and terminal areas more or less mixed with white; a more or less well-marked round white spot on costa beyond $\frac{1}{3}$, containing a black costal dot; costa posteriorly black strigulated with white, with a very oblique leaden striga close beneath it from beyond middle ; sides of ocellus marked by broad undefined bluish-leaden suffusion ; a white longitudinal strigula beneath apex : cilia light red-brownish, with a blackish-grey subbasal line, at apex more or less spotted with blackish-grey. Hindwings dark fuscous, rather thinly scaled, becoming blackish-fuscous posteriorly ; cilia grey, with dark fuscous basal line, beneath apex tinged with red-brownish.

Palnis, 6,000 feet (Campbell) ; Khasis ; from August to October, eight specimens.

Argyroploce tetanota, n. sp.

♂ ♀. 21-23 mm. Head and thorax brownish sprinkled with whitish-ochreous, forehead darker reddish-brown. Palpi ascending, brownish or reddish-brown, sometimes sprinkled with dark fuscous. Abdomen rather dark fuscous, in ♂ with large median lateral expansible tuft of hairs. (Posterior tibiæ in ♂ broken.) Forewings elongate, rather dilated, costa slightly arched, apex obtuse, termen somewhat rounded, rather oblique ; dark fuscous more or less sprinkled with ochreous-whitish, appearing irregularly strigulated ; two pairs of whitish costal strigulæ before middle, three beyond middle, and two single ones towards apex ; basal half crossed by irregular suffused subconfluent dark leaden striæ ; five oblique leaden lines from postmediam costal strigulæ uniting near costa to form two broad dark leaden streaks crossing wing to before and beyond tornus ; some whitish marking on termen beneath apex and below middle : cilia brownish sprinkled with ochreous-whitish, indistinctly barred, with dark fuscous subbasal line. Hindwing fuscous, with broad terminal band of dark fuscous suffusion ; dorsum in ♂ forming a pocket filled with long expansible hairs above ; cilia whitish fuscous, with fuscous subbasal line, in ♂ beneath with bright violet reflections.

Khasis, in July ; two specimens. Allied to *aprobola*, Meyr.

Argyroploce rupifera, n. sp.

♂ ♀. 16-17 mm. Head and thorax pale brownish mixed with fuscous thorax with indications of angulated transverse bars. Palpi subascending, whitish-ochreous, second joint with two blackish spots near upper edge, and a patch of indigo-blackish suffusion towards apex beneath. Abdomen dark fuscous, anal tuft of ♂ mixed with ochreous-yellowish. Posterior tibiæ in ♂ above with a median tuft of expansible ochreous-whitish hairs. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen somewhat sinuate, nearly vertical, rounded beneath ; fuscous, sometimes much mixed with leaden, tips of all scales whitish, all markings edged with whitish ; costal edge dark fuscous strigulated with white ; basal patch indicated by some irregular brown or dark fuscous marks, edge angulated ; a dark brown trapezoidal blotch extending on dorsum from $\frac{2}{5}$ to $\frac{4}{5}$, broadest anteriorly, reaching nearly half across wing ; a more or less marked semioval brown spot on costa beyond middle, marked posteriorly with an oblique leaden striga ; an irregular sinuate fuscous or dark fuscous streak rising in disc before middle and running to termen beneath apex ; a triangular patch of leaden striation above posterior portion of dorsal blotch, and another beyond tornus, indicating sides of ocellus : cilia brownish irrorated with ochreous-whitish, especially towards tornus, with a dark fuscous spot above apex, and a patch of dark fuscous suffusion above middle of termen. Hindwings dark fuscous, lighter anteriorly, costal area whitish ; cilia grey, becoming whitish towards tips, with dark fuscous subbasal line.

Khasis, from October to December ; twelve specimens.

Argyroploce callichlora, n. sp.

♂. 18 mm. Head and thorax yellowish-green, thorax crossed by a bar of whitish irroration. Palpi subascending, green, towards base whitish-ochreous. Abdomen dark grey, anal tuft pale ochreous. Posterior tibiæ somewhat rough-scaled. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen somewhat sinuate, little oblique ; uniform light glossy bluish-grey, markings rather deep green, partially finely edged with white ; costal edge white ; basal patch represented by spots on costa at base and $\frac{1}{5}$, and a triangular blotch on dorsum near base ; central fascia slender, curved, edged with black on costa and posteriorly in disc, anterior edge with a diamond-shaped projection downwards from above middle, marked above this with a triangular black spot, before which is a detached spot of green suffusion ; a slender curved streak from costa beyond middle to beneath costa at $\frac{3}{4}$, marked with black, edged beneath posteriorly by pale yellowish suffusion ; a suffused diamond-shaped blotch in disc posteriorly, darker and edged with black on upper anterior edge, discal space between this and two preceding markings suffused with white, with a black strigula in centre ; three semioval spots on costa posteriorly, partly edged with black, last followed by a small white spot ; some white specks on termen : cilia light greenish, beneath tornus dark grey, at apex with outer half blackish. Hindwings fuscous, towards apex broadly suffused with darker fuscous, costal area broadly whitish ; cilia whitish, with dark fuscous subbasal shade.

Khasis, in December ; one specimen.

Argyroploce herbifera, n. sp.

♂♀. 21-22 mm. Head and thorax yellowish-green, thorax sometimes with indistinct whitish bar, sometimes suffused dorsally with ferruginous-yellow (unless these are faded). Palpi subascending, green, base whitish beneath. Abdomen dark grey. Posterior tibiæ rough-scaled beneath. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen straight, somewhat oblique rounded beneath ; purplish-ashy-grey, darker towards costa ; markings rather deep yellowish-green ; an oblique basal fascia, posterior edge marked with black on upper half ; a small black costal spot beyond this ; an irregular rather oblique transverse streak at $\frac{1}{4}$, much marked with black on upper $\frac{2}{3}$, space between this and central fascia suffusedly mixed with white and spotted with black ; central fascia narrow, rather irregular, much suffused with black on upper half, anterior edge with a large irregular downward projection from above middle ; a large irregular quadrilateral blotch touching tornus and termen and reaching $\frac{3}{4}$ across wing, more or less strigulated and edged with black, upper anterior side margined by a white V-shaped mark pointing upwards, above which is a suffused green spot ; three semioval spots on costa posteriorly more or less suffused with black, separated by pairs of white strigulæ ; some white and black scales on termen : cilia dull green, irregularly barred with blackish. Hindwings fuscous, rather darker in ♂, suffused with dark fuscous towards apex ; cilia light fuscous, with dark fuscous subbasal line.

Khasis, in October ; Maskeliya, Ceylon, in May (de Mowbray) ; four specimens.

Argyroploce semicalta, n. sp.

♂ ♀. 21-22 mm. Head dull greenish, face dark fuscous. Palpi ascending, dull greenish, suffused with dark fuscous beneath and towards apex. Thorax dull green, crest suffused with ferruginous-brown. Abdomen dark grey. Posterior tibiæ in ♂ rough-scaled beneath and towards base above. Forewings elongate-triangular, costa moderately, in ♂ beyond middle rather strongly arched, apex in ♂ rectangular, in ♀ obtuse ; termen in ♂ subsinuate, rather oblique, in ♀ nearly straight, little oblique ; light dull green, indistinctly strigulated with dark grey irroration ; two large subtriangular dark red-brown blotches mixed with blackish resting on central and apical thirds of costa, reaching $\frac{3}{4}$ across wing, subconfluent towards costa but including a spot of ground colour more or less marked with white on upper angle of cell ; on costal edge of these blotches are several pairs of whitish strigulæ, whence proceed in distinct oblique purplish streaks : cilia reddish brown mixed with blackish. Hindwings in ♂ with abrupt rounded prominence in middle of termen, concave above and below this, upper margin of cell above with a ridge of dense scales, dark fuscous, in ♂ paler and thinly scaled towards base and dorsum ; cilia whitish-fuscous, with dark fuscous subbasal shade.

1 ♂, Hakgala, Ceylon, in April (Green) ; 1 ♀, Khasis, in November.

Argyroploce gyrotis, n. sp.

♀. 15-17 mm. Head, palpi, and thorax fuscous or brown tinged with ferruginous ; palpi porrected. Abdomen dark grey. Posterior tibiæ with tolerably appressed scales. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen slightly rounded, somewhat oblique ; ferruginous brownish more or less overlaid with purplish-leaden-grey, markings dark ferruginous-brown, partialliy finely edged with whitish ; an oblique transverse blotch from dorsum marking lower half of edge of an angulated basal patch ; a small triangular dorsal spot beyond this ; central fascia rather narrow, curved, oblique, posterior edge well-defined, anterior suffused and dilated into a large blotch projecting downwards in disc ; a rounded blotch before middle of termen, well-defined above, suffused beneath ; an oblique spot on costa at $\frac{2}{3}$, and two or three oblique strigæ beyond this : cilia ferruginous-brown, towards tornus suffused with grey. Hindwings dark fuscous, lighter anteriorly ; cilia grey irrorated with whitish, with dark grey subbasal shade.

Khasis, in June and July ; nine specimens.

Argyroploce aeraria, n. sp.

♂♀. 13-15 mm. Head, palpi, and thorax whitish-ochreous, sometimes faintly rosy-tinged, palpi ascending. Abdomen blackish, segmental margins yellow. Posterior tibiæ with appressed scales. Forewings elongate, posteriorly dilated, costa slightly arched, apex rounded-obtuse, termen slightly rounded, somewhat oblique ; varying from olive-greenish or brownish-ochreous to bright deep ferruginous, sometimes partially sprinkled with black; usually more or less distinctly ferruginous towards tornus ; three cloudy streaks varying from pale pinkish to orange, *viz.*, costal and median streaks from base to near middle, and one from near costa before apex to near middle of dorsum ; some irregular scattered blue-leaden marks specially on a longitudinal supramedian series ; area between these streaks and beneath median sometimes suffused with dark red-brown, sometimes partly mixed with black ; apical area sometimes suffused with crimson : cilia varying from ochreous to ferruginous. Hindwings with 3 and 4 usually short-stalked ; blackish ; an irregular variable orange-yellow streak in disc from base to middle, slenderly attenuated anteriorly, and an elongate-triangular spot above its posterior extremity ; cilia whitish, with blackish basal line.

Khasis, from December to March ; fourteen specimens.

Argyroploce solaris, n. sp.

♀. 14-15 mm. Head and thorax whitish-ochreous tinged with rosy, and mixed with reddish-fuscous and dark fuscous. Palpi ascending, whitish-ochreous tinged with rosy, with one or two blackish dots. Abdomen blackish, segmental margins orange. Posterior tibiæ with appressed scales. Forewings elongate, posteriorly dilated, costa slightly arched, apex rounded-obtuse termen, almost straight, rather oblique ; reddish-fuscous, more or less rosy-tinged, irregularly mixed with ochreous-whitish and sprinkled with dark fuscous ; numerous irregularly scattered small dark leaden-grey marks or strigulæ, sometimes partly marked with black, the most conspicuous being two irregular oblique spots from costa at $\frac{1}{3}$ and $\frac{1}{2}$, and a smaller spot at $\frac{2}{3}$; costal edge yellowish ; a fine black terminal line : cilia reddish-fuscous, mixed with ochreous-whitish, and somewhat barred irregularly with blackish. Hindwings bright orange ; irregular black costal, submedian, and dorsal streaks, connected with a broad black terminal fascia ; cilia orange, base blackish round apex and upper part of termen.

Khasis, in October and November ; three specimens. A specimen from same locality, with similar hindwings, but forewings deep coppery-orange with numerous irregular dark leaden-grey spots is probably a variety only, though at first sight very different.

Argyroploce callicratis, n. sp.

♂. 15 mm. Head dark fuscous mixed with white. Palpi ascending, white Thorax greyish-white, with a small spot on each shoulder, a cruciform mark on back, and two posterior spots black. Abdomen blackish, segmental margins yellow. Posterior tibiæ rough-scaled above on anterior half. Forewings elongate, posteriorly dilated, costa almost straight, apex rounded-obtuse, termen slightly rounded, somewhat oblique ; grey, strewn with moderate dark bluish-leaden rounded spots, interspersed with irregular black marks ; a white basal patch, extended as a moderate streak along costa to $\frac{3}{4}$, enclosing a blackish spot on base of dorsum, costal edge with minute dark grey strigulæ ; a very pale pinkish spot beneath costal streak beyond middle, and a pale pinkish-grey streak from beyond this to termen above tornus, beyond which the apical area is black, enclosing several round dark blue-leaden spots and two or three white marks : cilia dark grey, base brownish, on upper half of termen sprinkled and indistinctly barred with whitish. Hindwings blackish ; an elongate orange discal patch extended as a narrow streak to base, partially interrupted by a blackish vein, and an ill-defined orange-yellow subdorsal streak beneath this ; cilia white, with dark grey basal shade.

Khasis, in October ; one specimen.

Argyroploce tonica, n. sp.

♂ ♀. 12-14 mm. Head and thorax dark fuscous irrorated with whitish. Palpi ascending, whitish, second joint mixed with dark fuscous except towards apex and beneath. Abdomen rather dark fuscous, anal tuft in ♂ ochreous-whitish. Posterior femora in ♂ with long projecting white hairs beneath, posterior tibiæ in ♂ with rough white scales above and beneath. Forewings elongate, narrow towards base, dilated posteriorly, costa almost straight, rather bent near apex, apex obtuse, termen slightly sinuate, hardly oblique ; 3 strongly curved, 3-5 rather approximated posteriorly ; dark brown, finely irrorated with whitish ; costa marked with oblique whitish strigulæ ; from dorsum between $\frac{1}{4}$ and tornus several cloudy lines of whitish irroration converge to $\frac{4}{5}$ of costa, the interspaces partially streaked indistinctly with leaden-grey; and a similar whitish line from middle of termen tends to unite with last of these beneath costa, enclosing a triangular patch more or less tinged with leaden-grey ; a more or less defined small apical spot of blackish suffusion : cilia ferruginous-brown, paler towards tornus. Hindwings fuscous, suffused with dark fuscous posteriorly ; cilia grey, with dark grey basal shade, suffused with brownish round apex and upper part of termen, more or less whitish towards dorsum.

Maskeliya, Kandy, and Haldamulla, Ceylon (Green, Pole) ; Khasis ; in May, and from August to December ; eight specimens.

Argyroploce dimorpha, n. sp.

♂ ♀. 11-13 mm. Head and thorax whitish ochreous, sometimes suffused with brown-reddish. Palpi ascending, ochreous-whitish, sometimes reddish-tinged, with two small blackish spots on second joint above, and usually one on base of terminal joint. Abdomen fuscous or dark fuscous, anal tuft of ♂ mixed with ochreous-whitish. Posterior tibiæ with appressed scales. Forewings elongate, rather dilated posteriorly, costa slightly arched, apex obtuse, termen slightly rounded, vertical ; whitish-ochreous or pale clay-colour, more or less strigulated or striated with fuscous or dark fuscous, sometimes sprinkled with black, sometimes largely or wholly suffused with brown-reddish ; costa black, obliquely strigulated with whitish ; a roundish spot in disc before middle, and a suffusion along costa from near base to near apex grey or fuscous, sometimes much mixed with blackish and extending over whole basal area ; sometimes two or three fine leaden strigæ from costa, and a leaden streak on posterior margin of ocellus ; sometimes a fine black terminal line : cilia pale greyish-ochreous or whitish-ochreous, sometimes suffused with brown-reddish. Hindwings fuscous, thinly scaled, posteriorly broadly suffused with dark fuscous ; cilia grey-whitish, sometimes reddish-tinged round apex, with blackish-grey subbasal line.

Khasis, from October to March ; twenty specimens.

Eucosma, Hb.

This name is now applied to the genus formerly called *Epiblema*, Hb.

Eucosma ceriodes, n. sp.

♂ ♀. Head, palpi, and thorax ochreous or ochreous-brownish, palpi ascending. Abdomen grey. Forewings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen sinuate, rather oblique ; yellow-ochreous, variably suffused with brownish or dark fuscous on costal half or sometimes wholly (especially in ♀) ; sometimes irrorated with black except towards dorsum ; costa marked with pairs of whitish strigulae, whence proceed irregular bluish-leaden transverse striæ, sometimes much marked with white on antemedian area, but often more or less wholly obsolete : oscellus represented by a more or less defined irregular white streak from termen beneath apex to dorsum before tornus, marked with four or five short black dashes, and followed by a thick leaden metallic streak ; apex of wing ferruginous-ochreous : cilia ochreous, sometimes with two or three grey lines, with a whitish tornal patch, and sometimes a whitish subapical spot. Hindwings varying from greyish-ochreous to rather dark fuscous ; cilia whitish-ochreous or pale greyish-ochreous, sometimes with an indistinct grey line.

Khasis, from July to September : ten specimens. Allied to *ancyrota*, Meyr., but less narrow-winged.

NOTES ON SNAKES COLLECTED IN UPPER ASSAM.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

During nearly two years' residence in Assam I collected 615 snakes representing 37 different species. This does not include the collection of 264 snakes I made in the Khasi Hills in the hot weather of 1907.

To be accurate I spent but 17 months in the Plains of Assam being stationed at Dibrugarh all this time.

Nearly all my specimens were collected in and around Dibrugarh by my own efforts, aided by the substantial help of many Planter friends. In addition to those living close at hand I received help from others at a distance, and my thanks are especially due to Mr. Cyril Gore of Jaipur (Namsang), Mr. Stevens and Dr. Elmes of North Lakhimpur (Dejoo and Joyhing), and Mr. J. H. Bandock of Tinsukia, (Rangagara).

Dibrugarh is situated on the South bank of the Brahmaputra, at an elevation of 360 feet above sea level. The nearest Hills are the Abar Hills, which are part of, or at any rate, conterminous with, the Himalayas. These hills are about 25 miles distant. The Tippum Hills on the North of the Dihing River, and the Patkoi Range to the South of that river lie to the South-East of Dibrugarh, their nearest points being some 35 miles distant.

The average annual rainfall is 114·99 inches. This is distributed over several months in the year, unlike what obtains in India. Thus in the hot weather instead of the scorching drought of India, rain falls plentifully at spasmodic intervals, separated by spells of a few days fine weather. The result is a very humid atmosphere, and a most luxurious vegetation. The cold weather is pleasant, fires are a necessity from about November to February, and it often freezes at night. During these months few snakes were about, though plentiful during other parts of the year.

It will be seen from the annexed register, which is made out in tabular form that of the 615 specimens 555 were harmless and 60 poisonous. There were thus 2 poisonous snakes in every 20.

No case of snake poisoning came to my knowledge, and on making enquiries at the Civil Hospital I was told that no case of snake poisoning had ever been treated there.

TYPHLOPIDÆ.

Typhlops braminus (Daudin).

I obtained 15 specimens, mostly in the months of April and May, and all in Dibrugarh. No less than 9 of these were ♀♀, and all gravid in April and May. The rest I believe were ♂♂. All the ♀♀ ranged in length between 6 and 6⅜ inches. There are at least two distinct colour varieties, the one dark-brownish, or brownish-black, and the other a very pale grey similar to the colour of a new slate pencil for which I propose the name *pallidus*. I got three specimens of the latter which is evidently less common. In all of these specimens the eyes were quite invisible, differing thus from typical examples of this species, but I could observe no differences in lepidosis between them and the common variety.

In the gravid specimens the eggs varied in number from 2 to 7, were very elongate and resembled grains of boiled rice. The largest measured $\frac{2\frac{1}{2}}{32}''$ × $\frac{5}{32}''$. In life it is an agile restless little creature. I noticed the tongue which was white at the tips protruded as in other snakes. It is difficult to hold owing to its glossy scales, and agility. In one's grasp it pushes vigorously with its head, and insinuates itself forcibly between the clefts of the figures, at the same time depressing its caudal extremity so as to push the little spine with which it is endowed against the skin with sufficient force for one to be sensible of its acuity. It seems to use this little spine to anchor itself, whilst t circles round it as on a pivot.

Typhlops diardi, Schlegel.

Twenty specimens, 14 from Dibrugarh, 3 from Sadiya and one each from near Tinsukia, near Doom Dooma, and near Halem. One adult specimen was of a very pale grey colour, constituting a distinct colour variety for which I suggest the name *cinereus*. In this the eyes were almost invisible. In most of the specimens the scales were 24 in midbody though 26 rows were not infrequent. I notice that the rows reduce posteriorly by two, thus at a point two heads-lengths before the anus they are 22 when the scales are 24 in midbody, and 24 when 26 in midbody. The absorption appears to be due to the disappearance of the row next to the median ventral, either into the median ventrals or the row on the outer side. I also noticed that in certain specimens the median ventral row is a shade broader than the adjacent rows. I think at any rate whether the enlargement is constant or not that the median ventral row should be considered ventrals in all the snakes of this family, and the *Glauconiidæ*. If so considered the costals would be in odd rows, as in almost every other snake. In species in which the vertebral row is not enlarged, the median dorsal row is still the vertebral, and to be consistent the median ventral row should still be considered a true ventral though not enlarged. Analogy seems to me to indicate that this is the proper way to view these shields.

I had several specimens brought to me alive. It is a restless creature that is difficult to hold partly by reason of the slipperiness of its scales, and partly through its constant struggles. In moving it presses its terminal spine into the hand. I noticed that in progression the posterior part of the body is flicked round, and the terminal spine fixed to the ground two or three inches forward. From this purchase the snake pushed the posterior body forwards till the snake was completely extended in its whole length when the caudal extremity was again flicked forwards and the spine again fixed. Placed in my bath I was surprised to see with what activity it was able to swim, its powers in this direction seeming as good as that of other snakes. In loose dry earth it pushed its head through the surface layers with great ease, often burrowing so superficially that much of its body was visible, but in damp or wet earth it plunged at once to some depth, and when sought for resisted traction efforts with considerable strength. Two ♀♀ were gravid, one on the 30th April, and one some time between the 1st March and 9th May. In one case there were 5 and in the other 6 eggs. One gravid specimen measured 11¼ inches. In the stomach and intestines of many I found numerous white oval bodies which I submitted to Dr. Annandale for favour of identification. These proved to be larvæ and pupæ of ants, and in many specimens too I found the cases of ant imagoes sometimes entire. Ants appear therefore to furnish the staple food of this snake. In one specimen both the parietals were confluent. The tongue in life has white tips.

BOIDÆ.

Python molurus (*Linne*).

This species is common in Assam. I had 4 specimens brought to me, all quite young, and I saw several large skins in Planters' bungalows. In my specimens the ventrals and subcaudals were as follows :—260+68, 263+68 and 256+68. In one the 54th, 55th, 58th to 62nd, and 65th and 66th subcaudals were entire. The anal was entire in all. At a point two heads lengths after the head the costals in three were respectively 54, 56 and 56 rows, at midbody 69, 63 and 70, and two heads-lengths before the anus 44, 44 and 43. I notice that the last 4 costal rows progressively increase in size the last being just one-half the breadth of the ventrals. Several Planters and others gave me information about the specimens they had encountered. Dr. Elmes shot one 19 feet long which he saw lying on a little knoll in a jheel ("bhil" is the local name for these sheets of water). It had swallowed two large and two small water rats, and two or three toads. His servants last year killed a specimen in his fowl house about 12 to 14 feet long. It presented a beaded appearance, and when opened was found to contain 5 of his ducks, 4 fowls and 1 pigeon. A neighbour of Dr. Elmes killed one last year which contained a barking deer. He personally saw the deer cut out and judged the horns to be fully a foot long. These, he says, were softened and rounded off at the tips as a result of digestive activity. Mr. Staunton had one brought in to him that had swallowed three farmyard ducks. Mr. Copeland had a 15 footer killed on his estate last year, which had eaten a hog deer. The snake when surrounded, and hustled by his coolies, tried to make off, but in so doing the horns of the deer, some 7 or 8 inches in length, penetrated the flanks, and protruded through the ribs. Mr. Harry has a large skin preserved. When killed, the snake was found to contain a barking deer the horns of which were four to six inches in length. Mr. J. H. Mitchell wrote to me from Halem of a specimen he had lately killed in the act of swallowing a fowl. When opened, he found "about a double handful of earthworms and a handful of a berry, which the natives call jaman," in the stomach. Though pythons are known to be fairly omnivorous, this is the first time that I have ever heard of either worms or fruit being ingested, and it is difficult to account for such material in the stomach except as the result of deliberate intention. Pythons harbour many parasites, but it is difficult to believe that any of these could be mistaken for earthworms.

COLUBRIDÆ.

Tropidonotus piscator (Schneider)

Called by the Assamese "dhora." On one occasion when one was killed at the railway workshops all the Indian coolies agreed in calling it "dhor" but the Assamese present called it "dhora" the name I have on other occasions always heard them use for this species.

This snake is as plentiful in the Plains of Assam as it is in most other parts of our Indian Dominions. The great majority of specimens have large, and very conspicuous black spots conforming to variety *quincunciatus* of Schlegel. A fair number had small black chequering, and in others chequering was obscure or absent. Many of these appeared to me to be approaching their ecdysis, and for this reason were sombrely decked. I could discern the indications of dark chequering, and believe that in many cases, if not all, the desquamation would have revealed the typical black ornamentation. Of variety *quincunciatus* I saw none ornamented with red. 111 specimens—not including those I hatched from eggs—came to bag, and a record of those that call for remark had best be shown in tabular form. It is remarkable what a marked preponderance there is of ♀ over ♂. Of 77 specimens sexed by me 57 were ♀♀, and of 8 hatchlings of the same brood 6 were ♀♀.

Date.	Sex.	Length.	REMARKS.
1907.			
March 21st...	♀	1′-8$\frac{5}{8}$″	
April 1st ...	♀	3′-6$\frac{1}{2}$″	Contained 39 eggs (23+16) $\frac{13}{16}$″ to $\frac{15}{16}$″ long.
„ 1st ...	♂	2′-6$\frac{3}{4}$″	
„ 3rd ...	♀	3′-5″	Contained 44 eggs, the longest 1$\frac{2}{16}$″ long.
„ 8th ...	♂	1′-10$\frac{1}{2}$″	
„ 10th .	♀	3′-2$\frac{1}{2}$″	Very thin, probably had just laid eggs.
„ 13th ...	♀	3′-9$\frac{1}{4}$″	Contained 51 eggs (25+26,) $\frac{19}{20}$″ to 1″ in length in two rows.
„ 19th ...	♀	4′-1$\frac{1}{4}$″	Contained 53 eggs (33+20) $\frac{29}{32}$″ long.
„ 20th ...	♀	3′-6″	Contained 21 eggs, $\frac{30}{32}$″ to $\frac{31}{32}$″ long.
„ 23rd	♀	3′-0$\frac{1}{2}$″	Contained 34 eggs (21+13) $\frac{15}{16}$″ long.
„ 27th ...	♀	2′-4$\frac{1}{2}$″	
„ 28th ...	♂	1′-11$\frac{1}{2}$″	
May 1st ...	♀	1′-9$\frac{1}{2}$″	
„ 1st ...	♀	3′-5$\frac{3}{4}$″	Contained 44 eggs (21 + 23) $\frac{27}{32}$″ long.
„ 9th .	♀	2′-10$\frac{1}{4}$″	
„ 10th ...	♂	1′-4$\frac{1}{2}$″	

Date.	Sex.	Length.	REMARKS.
1907.			
May 14th ...	♀	4'-2$\frac{3}{4}$"	
,, 16th ...	♀	1'-11"	
,, 23rd ...	♀	......	Very thin, probably had just laid eggs.
,, 26th ...	♂	2'-0$\frac{3}{4}$"	
,, 30th ...	♂	1'-10$\frac{1}{4}$"	
......	♂	2'-0"	
June 10th ...	♀	2'-0$\frac{1}{2}$"	
,, 10th ...	♂	1'-11"	
,, 12th ...	♂	2'-2$\frac{3}{4}$"	
,, 13th ...	♀	1'-9$\frac{1}{4}$"	
,, 13th ...	♂	2'-3$\frac{1}{2}$"	
,, 14th ...	♂	2'-8$\frac{1}{2}$"	
,, 16th ...	♀	2'-10$\frac{1}{2}$"	
,, 17th ...	♀	6$\frac{3}{4}$"	A hatchling, tail slightly docked.
,, 19th ...	...	...	Very small, probably hatchling.
,, 20th ...	♀	9$\frac{1}{4}$"	
,, 21st ...	♀	7$\frac{1}{2}$"	
July 7th ...	♀	2'-4$\frac{1}{2}$"	
,, 11th ...	♂	1'-11"	Had eaten a mouse.
,, 23rd ...	♀	10"	
Oct. 12th ...	♀	3'-9$\frac{1}{4}$"	The nasals touch one another in front of the internasals.
,, 29th ...	♀	3'-9"	
Nov. 13th ...	♀	3'-2"	Had eaten a very large toad (*Bufo melanostictus*) breech first.
Dec. 30th ...	♂	...	
,, 30th ...	♀*	3'-5$\frac{1}{2}$	31 small eggs (15+16), $\frac{1}{2}$" long.
,, 30th ...	♀	3'-3$\frac{1}{2}$"	22 small eggs, rather larger than last. These 3 specimens were all captured in removing a stack of bricks in a brick kiln. They were not in company but evidently attracted by the warmth.
1908.			
Jan. 3rd ...	♀	3' 3"	Contained 37 eggs (24+13) $\frac{6}{16}$" to $\frac{9}{16}$" long.
,, 5th ...	♀	...	Containing 25 eggs (12+13) $\frac{5}{8}$' × 1$\frac{1}{4}$" long.
,, 14th ...	♀	3'-5"	Contained 22 eggs (17+5) $\frac{5}{8}$" × 1$\frac{5}{2}$".
Feb. 9th ...	♀	1'-9$\frac{1}{2}$	The nasals touch behind the rostral. 4 postoculars on left side. 9 supralabials, the 4 left only touching the eye.
,, 9th ...	♀	2'-1$\frac{3}{8}$"	The nasals touch behind the rostral.
,, 9th ...	♂	2'-10$\frac{1}{2}$"	A frog "in gastro"
,, 9th ...	♀	3'-3$\frac{1}{2}$"	Contained 8 eggs (5+3) $\frac{5}{8}$" long. A large fish "in gastro." 10 supralabials, the 5th left only touching the eye.
,, ,, ...	♀	3'-8$\frac{1}{2}$"	Contained 49 eggs (21+28) $\frac{5}{8}$" long. Remains of frog in stomach. Four postoculars on both sides.
,, 22nd ...	♀	...	Contained 19 eggs (9+10) $\frac{5}{8}$" long.
,, 23rd ...	♀	1'-11"	Only 5th supralabial touching the eye on the right side.
,, 25th ...	♀	3'-11"	Contained eggs $\frac{15}{16}$" × $\frac{10}{16}$. Four postoculars on both sides.
April 3rd ...	♀	3'-8$\frac{3}{4}$"	Contained 36 large eggs $\frac{3}{4}$" × 1"
,, 11th ...	♀	2'-10$\frac{1}{2}$"	Contained 21 large eggs.
Oct. 19th ...	♀		A large toad (*Bufo melanostictus*) "in gastro"

* The tail was very incomplete but the full length is judged from other specimens of same body length.

In some of the gravid ♀♀ it was observed that some eggs were particoloured having a cinereous suffusion on one aspect. It was also observed that the pigmented patch had lain in opposition to a distended part of the intestine—and there seems little doubt that this colouration is due to absorption from the intestinal contents. I suspect that it is derived from pigment in the batrachian epidermis.

On the 21st May 1907 I received two large clusters of eggs of this species both unearthed in hoeing operations on a tea estate. One of these like a bunch of grapes contained 75 eggs. I extracted a ♀ embryo which measured 4⅜ inches. The ventrals numbered 149, of which the 21st to 27th lay beneath the heart and the 84th beneath the gall bladder. A median raphé on the belly marked the union of the parietes, but the bond of union was so delicate that the slightest touch ruptured it, and allowed the viscera to protrude. The oviducts could be seen arising from just before the gall bladder and passed backwards as two tortuous, vermiform, white threads.

These embryos began to hatch on the 14th of June. I examined 8 of these critically. 6 were ♀♀ and 2 ♂♂. The ♀♀ varied in length from 6⅜ to 7⅞ inches, the average being a shade under 7½ inches. It will thus be seen that these embryos grew at the rate of a little more than three inches in 24 days. The ventrals in the ♀ specimens varied from 150 to 152, in the ♂ from 141 to 145. The subcaudals in the ♀♀ ranged from 81 to 87 and in the ♂♂ from 91 to 95.

On the heads of all these specimens was a pair of small light spots one on each parietal, opposite the middle of the interparietal suture. I have observed these, I think, in all other hatchlings of this species, but they seem soon to disappear. In one of these specimens the 3rd subcaudal was entire. All of these were conspicuously spotted as in variety *quincunciatus* except one in which the black spots were obscure. The fœtal tooth could not be seen in profile, but could be felt when searched for.

In the second cluster there were 30 odd eggs. I extracted an embryo two inches in length. The upper jaw was very imperfect and slightly cleft mesially. I could see no other gill arches though two sulci in the neck seemed to indicate the position of the 2nd and 3rd clefts. Immediately behind the rudimentary lower jaws lay the heart which could be observed pulsating.

These eggs shrivelled and the rate of growth of the embryos could not be ascertained. Some sepoys brought me in another clutch of eggs in the middle of June found in the river bank and reported that a snake was coiled up with them but escaped.

It will be seen that this species is common all the year round, more so in the hot weather.

This snake is usually infested with many parasites. The abdominal cavity is often teeming with an immature form of tapeworm which usually lies up under the lining membrane in a convoluted mass so large as to cause flattish blister-like swellings beneath the skin.

These parasites may attain a length of 8 or even 10 inches when extended. Dr. Annandale had them identified for me, and they were reported as a species of *Pterocercus* (larval forms of a tapeworm). Another common parasite is a small ascarid or round worm which inhabits the stomach (and upper part of the intestine?). It is frequently found in clusters attached firmly to the coats of the stomach, and the individuals of each colony vary a good deal in length. Some attain a length of 5 inches. I measured one 5¼ inches. This parasite sets up a chronic inflammatory thickening of the gastric coats. Sometimes the stomach becomes very much thickened, and indurated like cartilage. At the same time it is often puckered up, and distorted, and the surrounding tissues are often bathed in a watery dropsical fluid. This worm has been identified for me through Dr. Annandale as *Kalicephalus willeyi.* Larval and immature forms of another ascarid worm were found in the stomach and mesentery. A fourth parasite, which is less common, is frequently found attached to the outside coats of the intestine, or the lining membrane of the abdominal cavity. This is a maggot-like white parasite which has been also identified for me by Dr. Annandale as *Porocephalus brotali.* I have figured this curious creature showing the hooks by which it attaches itself.

Tropidonotus himalayanus, Gthr.

I collected 15 specimens, 10 from Dibrugarh, 3 from Jaipur, 1 from Sadiya, and 1 from near Tinsukia. 6 of the 8 specimens sexed were ♂♂, 2 ♀♀. The largest was a ♀ 2 feet 10 inches, the tail being 8½ inches. The total length of a ♂ in which the tail was 8½ inches was 2 feet 6½ inches, so that it is obvious that the tail is longer in the ♂. The specific name is unfortunate for this snake is by no means confined to the Himalayas, nor is it exclusively a hill snake being found in the Brahmaputra Valley at some distance from Hills (25 to 35 miles at least). I obtained more than one specimen alive, but could not get them to bite me though they raised themselves, and flattened the neck in the manner so typical of the *Tropidonoti.* More than one specimen had recently fed, on two occasions a frog had been taken, in another a small toad (*Bufo melanostictus*). A hatchling was captured alive on the 26th of July. In this, and in another specimen that measured 1 foot 4¼ inches the collar was of a bright orange colour. In larger specimens this tones down to a cinnamon brown. The collar is bounded with black fore and aft. The brilliant vermilion band behind the collar, breaking up into a chequering, which I remarked upon in specimens from the Khasi Hills in this Journal (Vol. XVIII, p. 319) is not seen in specimens in the Plains. The scales where they are overlaped are of a very beautiful greenish blue colour which sets off the snake to great advantage when it dilates itself under excitement. All the specimens were very dark, in fact blackish with a tinge of olive, and the costal series of spots were of a cinnamon hue. One specimen was disturbed from beneath a box inside a bungalow. The ventrals in a ♀ were 172, and in 6 ♂♂ varied from 168 to 173. The subcaudals in one ♀ were 86, and in 6 ♂♂ 89 to 95. There were 4 postoculars on one side in one example. I noticed that the double apical facets were very conspicuous in this species. The maxilla supports two large very compressed sabre-like teeth posteriorly which are fully twice the length of the preceding tooth, and separated from it by a short edentulous interval large enough to support one small tooth. These dental peculiarities are precisely those laid down by Mr. Boulenger to characterise his genus *Macropisthodon* as already pointed out by Annandale.*

Tropidonotus stolatus (*Linné*).

I collected 159 specimens, all but 20 from Dibrugarh. Of 89 sexed 62 were ♀♀, 27 ♂♂. The preponderance of ♀♀ over ♂♂ is remarkable, exceeding that already noted with regard to *T. piscator*. In none of these did I see any red ornamentation, the overlapped edges of the scales being always pale blue. Many of these were brought alive, and it is remarkable how its disposition contrasts with that of *T. piscator*. I have never been bitten by one though I have picked up many haphazard. The flattening of the neck is only seen in some specimens, though many erect their bodies. Some flatten themselves very remarkably, and in so doing reveal the pale blue colouring which is under other circumstances hidden. The breeding events, food, etc., will be best given in tabular form.

Date.	Sex.	Length.	Remarks.
1907.			
April 2nd ...	♂	1′-8″	2 præoculars on both sides.
„ 2nd ...	♀	1′-10$\frac{1}{3}$″	Contained 5 eggs, the longest $\frac{12}{16}$″.
„ 11th ...	♀	1′-11″	Contained eggs, the longest $\frac{7}{16}$″.
„ 11th ...	♀	tail docked.	Contained 6 eggs (4 + 2). $\frac{15}{16}$″ long.
„ 13th ...	...	10$\frac{3}{4}$″	
„ 15th ...	♀	...	Contained 5 eggs, $\frac{1}{2}$″ long.
„ 17th ...	♂	1′-7$\frac{1}{8}$″	A small toad "in gastro."
„ 22nd ...	♀	...	A toad "in gastro."
„ 25th ...	♀	...	Contained 9 eggs (4 + 5). $\frac{3}{4}$″ long.
„ 25th .	♀	...	Contained 1 egg.
„ 27th ...	♀	...	Contained 8 eggs, $\frac{3}{4}$″ long.
„ 27th ...	♀	1′-8″	Contained 5 eggs, $\frac{23}{32}$″ to $\frac{28}{32}$″ long.
May 1st ...	♀	...	Dug up coiled with 7 eggs, one inch long: One contained an embryo 2$\frac{5}{16}$″ long. Another clutch of 3 on same date.
„ 2nd ...	♀	...	Contained 6 eggs (4 + 2), $\frac{29}{32}$″ × $\frac{14}{32}$″.
„ 2nd ...	♀	...	Contained 4 eggs (3 + 1), $\frac{15}{32}$″ × $\frac{20}{32}$″ long.
„ 3rd ...	♀	...	Contained 8 eggs, $\frac{27}{32}$″ long.
„ 4th ...	♀	...	Contained 4 eggs (3 + 1) $\frac{1}{2}$″ long. On this date 5 other eggs were brought, measuring 1$\frac{1}{32}$″ × $\frac{14}{32}$″. A snake was reported to have been coiled up with them but escaped. Another clutch of 9 eggs also brought, one egg containing an embryo 3″ long.
„ 5th ...	♂	...	2 præoculars on both sides.
„ 8th ...	♀	2′-3″	Contained 9 eggs, $\frac{3}{4}$″ long.

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* Journal, Ass. Soc., Bengal, 1905, p. 210.

Date.	Sex.	Length.	Remarks.
1907.			
May 10th ...	♀	...	Contained 5 eggs.
„ 11th ...	♀ ♀	...	Two gravid specimens.
„ 11th ...	♀	*2′-6″	Contained 12 eggs, the poles much flattened from pressure against one another.
„ 11th ...	♀	...	Contained 5 eggs. Another on this date had the remains of a frog "in gastro" and another young specimen a gecko.
„ 19th ...	♀	...	Contained 7 eggs (4 +3).
„ 21st ...	...	...	Two clutches each containing 7 eggs were brought in.
„ 28th ...	♀	...	Gravid.
„ 31st ...	♀	2′-4″	Contained 9 eggs.
June 3rd ...	...	...	5 eggs were brought containing embryos, 4 ♀ ♀, 1 ♂.
„ 13th ...	♀	...	Contained several eggs.
„ 16th ...	...	...	A clutch of 6 eggs brought in.
„ 17th ...	♀	...	Contained several eggs. 9 eggs were also brought comprising two clutches.
July 2nd ...	♀	..	Contained 6 eggs.
„ 15th ...	♀	...	A frog "in gastro."
Sept. 18th ...	...	...	A frog "in gastro."
Oct. 18th ...	♀	...	Two loreals $(\frac{1}{1})$ on each side.
„ 30th ...	...	...	A frog in the gullet swallowed breach first.
1908.			
March 11th...	...	...	Two loreals $(\frac{1}{1})$ on each side.
„ 27th	♀	...	A toad "in gastro."
April 2nd ...	...	...	A frog "in gastro."
„ 3rd ...	..	...	A frog "in gastro."
„ 5th ...	♀	...	Contained 10 eggs, $\frac{13}{16}''$ long.
„ 20th...	♀	...	Gravid.
„ 24th...	♀ ♀	...	Two gravid.
Oct. 13th ...	♀	...	Two loreals $(\frac{1}{1})$ on each side.

* Total length judged from other specimens, the tail being imperfect. The body length was 1′-11½″.

Another spirit specimen probably a hatchling contained a frog. It is curious that Mr. Boulenger in his catalogue gives the supralabials as numbering 8 normally, with the 3rd, 4th and 5th touching the eye when this arrangement though not uncommon is the exception. The supralabials in this species are specially subject to variation. I find that in nearly all my specimens there are 7 with the 3rd and 4th touching the eye. Very frequently too there are 8 with the 4th and 5th touching the eye, and occasionally but 6 with 3rd and 4th touching the eye. In a very large number there is a long shield which suggests that two (usually the 3rd and 4th) have become confluent, but so often is this the case that one can hardly take this view. I cannot see any apical facets on the costal scales.

In a clutch of eggs brought on the 21st of May a ♂ embryo measured $4\frac{3}{8}''$. The genitals were extruded. Two of these hatched on the 10th June measuring 6″ and $6\frac{3}{8}''$. The sexes were not noted but there is no difference in size in this species at exovration. A growth of $1\frac{5}{8}$ to 2 inches was attained in 20 days. Of 5 eggs brought on the 3rd of June 4 embryos were ♀♀ and 1 ♂. The ♀♀ measured from $5\frac{3}{8}$ to $5\frac{4}{16}''$ and the ♂ $5\frac{14}{16}''$. The latter had the genitals extruded. On the 27th June 9 eggs were brought comprising two clutches. The embryos in one lot were $2\frac{1}{2}''$ long, and in the other a ♂ was $6\frac{1}{4}''$ and a ♀ $6\frac{1}{8}''$, the genitals of the former being still extruded. On the 5th July 3 of the second lot hatched, and on the 6th 2 more. One of these escaped but the others were examined, as follows:—

Sex.	Length.	Ventrals.	Subcaudals.	Ventrals between navel and anal.	REMARKS.
♀	7″	151	77	14	4th and 5th right supralabials confluent.
♀	$6\frac{3}{4}''$	153	77	15	4th and 5th supralabials confluent on both sides.
♂	$6\frac{1}{8}''$	145	72	18	4th and 5th supralabials partially confluent on both sides.
♂	6′	152	78	15	4th and 5th right supralabials confluent.

In 8 or 9 days the growth of these embryos was in the ♂ $\frac{3}{16}''$, and in the ♀ $\frac{2}{3}''$. At the period of exovration the ♂ genitals were no longer extruded.

In an embryo, which measured $4\frac{3}{8}''$, the claspers were sausage-shaped bodies dimpled posteriorly where evidently the muscle (or ligament ?) which retains the organ in its sheathed position in the adult is attached. By a contraction of this muscle shortly before hatching, the clasper would appear to become sheathed by being drawn within itself, much in the same way as the digits of a glove may be, on being withdrawn from damp fingers. In this specimen the ventrals were 157, the 26th to the 32nd covering the heart and the 88th and 89th the gall bladder. In an embryo $2\frac{1}{2}''$ long the heart was observed beating, first the auricle, and the ventricle contracting, the latter by its contraction making the transverse diameter of the organ as broad as its longitudinal diameter was in the interval (diastole). This snake is infested with just the same parasites as *T. piscator*. I sometimes found masses of the larval form of tapeworm (*Pterocercus*) in such quantity that I was misled into supposing a specimen gravid. The stomachs of several were very much thickened, indurated, and knuckled by the clusters of nemotade worms (*Kalicephalus willeyi*) which attach themselves to the inside coats of this organ. The third parasite (*Porocephalus brotali*) was also frequently observed attached to tissues in the abdominal cavity outside the alimentary canal. Some of these measured $\frac{3}{4}$ of an inch.

As regards dentition this appears to me to exactly agree with that of *T. himalayanus* and *subminiatus* in that the last two maxillary teeth are very much enlarged, and separated from the preceding one by a short edentulous gap.

Tropidonotus subminiatus, Schlegel.

I obtained 4 examples, 3 from Dibrugarh and 1 from near Halem. One of these I captured alive myself. It was disturbed by the servants, and took refuge in a small rubbish heap in a godown. When I flushed it, it erected the body, and flattened the neck very markedly, displaying it truly glorious colouration to the utmost advantage. The brilliant gamboge collar, intense vermilion band behind this, and the bright canary yellow chequering on the body were extremely ornamental and striking.

Apical facets are very distinct on the costal scales in this species.

Two specimens had eaten toads.

The dentition agrees with that of *T. stolatus* and *T. himalayanus*. There is a small gap between the small maxillary teeth and the two enlarged posterior ones. The latter are almost three times the length of the preceding tooth.

Trachischium monticola (Cantor).

I received one specimen from Mr. C. Gore of Namsang (near Jaipur). He tells me that he lives about 40 or 50 miles from the Naga Hills from which a spur runs in his direction, the altitude of which near him is perhaps 150 feet or so. In the plain where his estate is the altitude above sea level is only about 500 feet. It seems rather curious that this mountain species should be found at this low-level, but as will be seen hereafter Mr. Gore also sent me other mountain snakes from the same locality, viz., *Amblycephalus monticola*, *Dinodon septentrionalis*, and *Callophis macclellandi*. There is a specimen of this species in the Indian museum from Barrakur which I have examined. Barrakur though in the plains is within a short distance of the Parasnath Hill. The scales were in 15 rows in the whole body length. The ventrals and subcaudals 120 + 35.

Lycodon jara (Shaw).

Three specimens were collected. One I got in Dibrugarh, one from Sadiya, and one from Makum. The last was sent to me alive. It proved a very active spirited little reptile, striking out at me with great pluck and determination, and striving repeatedly by a series of jumps to escape. After being repeatedly brought back into the open, it sulked and made its body rigid as other Lycodons do. I turned it over on to its back, and it lay immobile belly uppermost as though feigning death. The tongue was noticed when protruded to have white tips. The ground colour of this species is black with a slight greenish tinge in it. The twin spots on each scale are yellow in life as already remarked by Theobald not white as stated by Boulenger. The collar too is yellow. As in other Lycodons the eye is black in life so that the pupil cannot be seen. In all the specimens I have seen including those from the neighbourhood of Darjeeling the supralabials are 8 with the 3rd, 4th and 5th touching the eye, not 9 or 10 as stated by Boulenger. The scales at a point two heads-lengths behind the head are 17, in midbody 17, and at a point two heads-lengths before the anus 15. As in other Lycodons the reduction from 17 to 15 is effected by a confluence of the 3rd and 4th rows above the ventrals. One specimen was imperfect. In the other two the ventrals and subcaudals were ♀ 185 + 66 and ♂ 190+71. The ♂ was 1 foot 7¼ inches long, the tail 4⅛ inches and the ♀ was 1 foot [illegible]½ inches, the tail 4 inches.

The dentition is similar to that of other Lycodons. The maxilla supports an anterior and a posterior set of teeth separated by a considerable arched edentulous interval. In the anterior set the first three teeth are small but progressively increase in size, then come two long fang-like teeth about twice as long as the 3rd. In the posterior set are 7 small subequal teeth, then two enlarged and fang-like about twice as long as the preceding. The palatopterygoid series number 13 + 16 and are all small and subequal. In the mandible there are anteriorly three small progressively increasing teeth followed by two large and fang-like, then a gap followed by 14 small subequal teeth.

Lycodon aulicus (Linne).

I acquired 47 specimens. Of 37 sexed 21 were ♂♂, and 16 ♀♀. The living ones that were brought were as usual very lively, and in their endeavours to secure their liberty moved in a series of jumps. I could not assert that the reptile left the ground, though it certainly sometimes appeared to do so. One specimen I encountered at night in my bathroom. It had just seized a gecko, but as soon as I came upon the scene with a light, it dropped the lizard and rounded upon me with open jaws in a most truculent manner. Breeding and other notes are given in tabular form :—

Date.	Sex.	Length.	Remarks.
1907.			
March 30th...	♂	1'-11"	Supralabials 10, the 3rd, 4th and 5th touching the eye on the right side. Seen in the roof of a house in the bazaar.
April 4th ...	♀	2'-4¾"	Gravid but eggs all broken up.
" 26th ...	♂	1'-9¼"	Found in upstairs room of bungalow. A gecko had been eaten.
" 26th ..	♂	1'-8¼"	Killed in a native house in daylight.
" 27th ...	♀	2'-6"	Contained 11 eggs (6 + 5), $\frac{28}{32}$" to 1" long. Killed in a native house.
May 5th ...	♂	1'-7"	Killed in the roof of a house.
" 8th ..	♀	1'-8½"	Contained 3 eggs, $\frac{22}{32}$" long. A mouse "in gastro."
" 10th ...	♀	1'-1½"	
" 15th ..	♂	2'-6"	
" 24th ...	♀	2'-1"*	Contained 6 eggs $\frac{30}{32}$" long.

* Tail imperfect, but length judged from other specimens. The body was 1 foot 9¾ inches long.

Date.	Sex.	Length.	REMARKS.
1907			
May 26th ...	♂	2′-3$\frac{1}{8}$″	Hair of mammal "in gastro." Killed in native hut at midnight.
„ 31st ...	♂	2′-0$\frac{1}{2}$″	
June 16th ...	♂	1′-1$\frac{3}{8}$″	3 postoculars on both sides. A gecko "in gastro". Killed in roof of a house.
„ 16th ..	♂	2′-0$\frac{1}{2}$″	
„ 18th ...	♂	1′-11$\frac{1}{2}$″	Ventrals and subcaudals 197+73.
„ 26th .	♀	1′-10$\frac{1}{2}$″	Ventrals and subcaudals 210+67.
July 9th ...	♂	1′-7″	The anal and the first 3 subcaudals entire.
„ 9th ...	♂	1′-9$\frac{1}{4}$″	Found on a beam in a house.
„ 13th ...	♂	1′-4$\frac{3}{4}$″	
„ 18th ...	♀	7$\frac{3}{16}$″	Ventrals and subcaudals 206+68. Killed in roof of native hut. A hatchling.
Oct. 7th ..	♀	1′-6$\frac{1}{2}$″	Ventrals and subcaudals 204+63.
„ 27th ...	♀	1′-8″	Had just siezed a gecko in bathroom of my house at night.
Nov. 11th ...	♀	1′-7″	Ventrals and subcaudals 205+65.
Dec. 2nd ...	?	9$\frac{1}{8}$″	
1908.			
Mar. 11th ...	♀	1′-0$\frac{1}{4}$″	Ventrals and subcaudals 197+69
April 10th ..	♀	...	Contained 6 eggs, $\frac{15}{16}$″ long.
„ 10th ...	♀	1′-9″	3 ovarian follicles apparently impregnated.
„ 10th ...	♀	2′-0″	Contained 8 eggs, rather more than one inch long.
„ 21st ...	♂	2′-1$\frac{7}{8}$″	Both found together in an old brick wall of a house. The ♀ contained 7 eggs varying from $\frac{13}{16}$″ to 1$\frac{1}{8}$″ long.
„ 21st ...	♀	2′-4″	
May 18th ...	♂	1′-11$\frac{1}{4}$″	Both found together in a hole in a bath-room. The second specimen was cut in half, and the anterior part only brought.
„ 18th ...	?	...	
„ 21st ...	♂	1′-7$\frac{1}{4}$″	A nearly digested gecko "in gastro."
June 5th ...	♂	1′-6$\frac{3}{4}$″	
Sept. 21st ...	♂	...	Killed in a house.
Oct. 18th ...	...	...	3 postoculars on the left side.

A spirit specimen sent to me had 9 supralabials with the 3rd, 4th, 5th and 6th touching the eye on the right side.

The specimens were all of one variety. The labials were spotted, mottled or sullied with brown, or uniformly whitish. The ground colour was brown of various shades, and the cross-bars yellow or yellowish, numbering 10 to 15 in the anterior half of the body. On the 18th July 5 eggs were found in a Planter's bungalow. Four of these hatched out one escaping; the fifth egg was not fertile. Two hatchlings measured 6$\frac{7}{8}$″ and one 6$\frac{3}{4}$.″ Two believed to be ♀ ♀ had the ventrals and subcaudals 209 + 66 and 208 + 67, and in both these 27 ventrals were interposed between the navel and the anal shield. In the specimen believed to be a male the ventrals and subcaudals numbered 197+68, and 28 ventrals intervened between the navel and the anal shield.

On the 31st July two hatchlings were discovered on a gun case in the corner of a room. One measured 6$\frac{7}{8}$″ and the other 7$\frac{1}{8}$″.

Dinodon septentrionalis (*Günther*).

I received a small living specimen from Mr. Gore captured at Namsang.* It was a very beautiful little snake with its coal-black ground colour and milky-white cross-bars, resembling very closely the many banded Krait (*Bungarus multicinctus*) for which I at first took it. In certain lights the black had a purplish tinge. There were 27 white bars on the body and 17 on the tail. It was a ♀, and measured 2 feet 1$\frac{5}{8}$ inches, of which the tail accounted for 5$\frac{1}{4}$ inches. The ventrals and subcaudals were 214 + 81, the former angulate. The anal entire. The scales at a point 2 heads-lengths behind the head were in 17 rows, at midbody 17, and at a point 2 heads-lengths before the anus 13. This last is unusual, the rows at this site being normally 15. The reduction from 17 to 15 caused by a fusion of the 3rd and 4th rows above the ventrals. The eye in life was quite black, but the pupil was subsequently noted to be vertical.

Zaocys nigromarginatus (*Blyth.*)

I may here mention that an Officer at Kohima in the Naga Hills sent me a coloured picture of a snake caught and killed in his garden on the 21st May, which had excited his admiration and interest. There can be no doubt as to its identity. The body is coloured foliaceous-green with the scales edged black. The head is brown on the snout, merging to green on the occiput. The characteristic black bands down the tail are also nicely shown. The specimen measured 7 feet 6 inches.

Zamenis korros (Schlegel).

Thirteen specimens were collected, all from Dibrugarh except one from Sadiya. Of those sexed 4 were ♂♂, 7 ♀♀ —

Date.	Sex.	Total length	Tail.	Ventrals.	Subcaudals.	Remarks.
1907.						
May 10th .	♂	5′-9″	……	186	135	One loreal on the right side.
,, 13th .	♀	5′-4$\frac{1}{4}$″	……	…	…	Tail imperfect. On the left side there were 3 loreals ($\frac{1}{1}$+1) Contained 5 eggs. 1$\frac{19}{32}$″ × $\frac{16}{32}$.″
June 12th .	♂	4′-10$\frac{1}{4}$″	1′-9″	182	147	9 supralabials on the both sides.
,, 18th .	♀	4′-9$\frac{1}{2}$″	1′-8″	…	…	9 Supralabials on the left side, the 5th and 6th touching the eye. Contained 3 eggs, 1$\frac{1}{2}$″ × $\frac{12}{32}$.″
,, 21st .	♀	4′-2$\frac{1}{2}$″	……	…	…	Tail imperfect. Contained 6 eggs, 1$\frac{1}{2}$″ × $\frac{1}{2}$″.
July 4th …	♂	5′-4$\frac{1}{2}$″	1′-10$\frac{1}{4}$″	182	146	
,, 18th .	♀	4′-8$\frac{1}{2}$″	1′-8$\frac{1}{8}$″	179	146	Contained 4 eggs (2+2), 1$\frac{14}{32}$″ × $\frac{13}{32}$.″
1908,						
June 2nd .	♂	3′-0$\frac{1}{16}$″	1′-0$\frac{1}{8}$″	…	…	
,, 4th…	♀	4′-10$\frac{1}{4}$″	1′-9$\frac{1}{16}$″	…	…	Contained 1 egg, 1$\frac{15}{16}$″.
,, 5th ..	♀	3′-1$\frac{1}{8}$″	1′-1$\frac{1}{2}$″	178	140	

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* See remarks on this locality under *Trachischium monticola*, p. 618.

In this species the costals are in 15 rows at a point two heads-lengths behind the head, 15 in midbody, and 11 at a point two heads-lengths before the anus. The scales reduce from 15 to 13 close behind midbody, the 3rd row above the ventrals being absorbed into the row above or below. Shortly afterwards the rows become 11 by a similar absorption process.

A specimen from Sadiya had but one loreal on both sides. The eggs when immature are extremely elongate resembling a date stone somewhat in shape. The length is often three times the breadth, but as they mature the relative breadth increases. The secretion of the anal glands is creamy-white.

The dentition in a skull before me is as follows:—*Maxillary.*—28 teeth in a continuous series, the posterior gradually and slightly enlarged. *Palato pterygoid.*—18+28, small and subequal. *Mandibular.*—25, the first 3 gradually increasing in size the next few teeth subequal to the 3rd and then there is a gradual reduction in length posteriorly. Boulenger in his catalogue gives among his generic characters a range of from 12 to 20 maxillary teeth. It is to be noted also that he states that the body in this genus is cylindrical. In both this and the next species there is a very notable compression of the body.

Zamenis mucosus (Linne).

The Assamese call this snake "Qwalla samp," and believe that it sucks the teats of cows. They state that they wind themselves round the cows' hind legs, and bind them, and then suck the milk.

Of 44 sexed 25 were ♂ ♂, 19 ♀ ♀. In my popular article on this snake, Vol. XVIII, page 257, I mentioned that contrary to what is the rule in snakes the ♂ of this species appeared to grow larger than the ♀. This receives substantial support from the notes I made in Dibrugarh. I find that I had no less than 9 ♂ ♂ exceeding 6 feet in length and only one ♀ ♀ which was 6 feet 2 inches. The longest specimen was 7 feet 4 inches. On one occasion one was found in the same hole as a large black krait (*B. niger*). On another occasion one was seen to disappear in a hole and when dug up two were flushed and killed, both females. On another occasion under similar circumstances two males were dug out of the same hole in May and in the hole was a cluster of egg shells which appeared to be those of a dhaman. They measured 1¾ inches in length, were 9 in number and obviously the production of last season. In a ♀ killed on the 30th April, 15 (9+6) follicles were impregnated. In another killed on the 12th June, there were 8 (6+2) eggs measuring $\frac{22}{32}$" long. In a third, killed on the 26th July, there were several eggs, $\frac{29}{32}$" long and $\frac{8}{32}$" broad. As in the case of the last species the eggs are remarkably elongate in their early stages of development. Several had recently fed. Toads of the species *Bufo melanostictus* had twice been taken, a frog twice, a large skink (probably *Mabuia carinata*) once, and a large fledgling twice, probably that of a crow in one instance, and a young ♂ koel in the other. The feathers of the latter were black tipped with rufous as observed by Dewar (*vide* this Journal, Vol. XVII, p. 781). One specimen had 5 loreals on both sides, and another had the 49th, 50th and 51st subcaudals entire.

The dhaman is of a very dark colour in this part of India, many specimens being sepia or black with the markings much obscured, so that at a very short distance they appear uniformly coloured.

One specimen, which was brought alive, but fortunately so damaged in the hind part of the body as to find progression difficult, struck out fiercely at me pouching the throat, and uttering that curious groaning note that I have heard no other snake produce. My wife who was with me at the time was also struck at and heard the noise to which I refer distinctly. One was re-reported to have been attacking a fowl when observed and killed.

ORCHIDS OF THE BOMBAY PRESIDENCY.

By G. A. Gammie, f.l.s.

Part IX (With Plate IX). (*Continued from page* 141 *of this volume*).

20. VANDA.

Epiphytes with two-ranked leafy stems. *Leaves* thick, folded on the midrib. *Flowers* in loose, erect racemes ; *bracts* small ; *sepals* and *petals* subequal, narrowed at the base ; *lip* smaller than those, *side-lobes* small, *disk* ridged, *midlobe* fleshy, dilated and two-lobed at apex ; *column* short, stout ; *foot* very shortly produced ; *anther* 2-celled, *pollinia* 2, didymous, globose or obovoid, *gland* rather large.

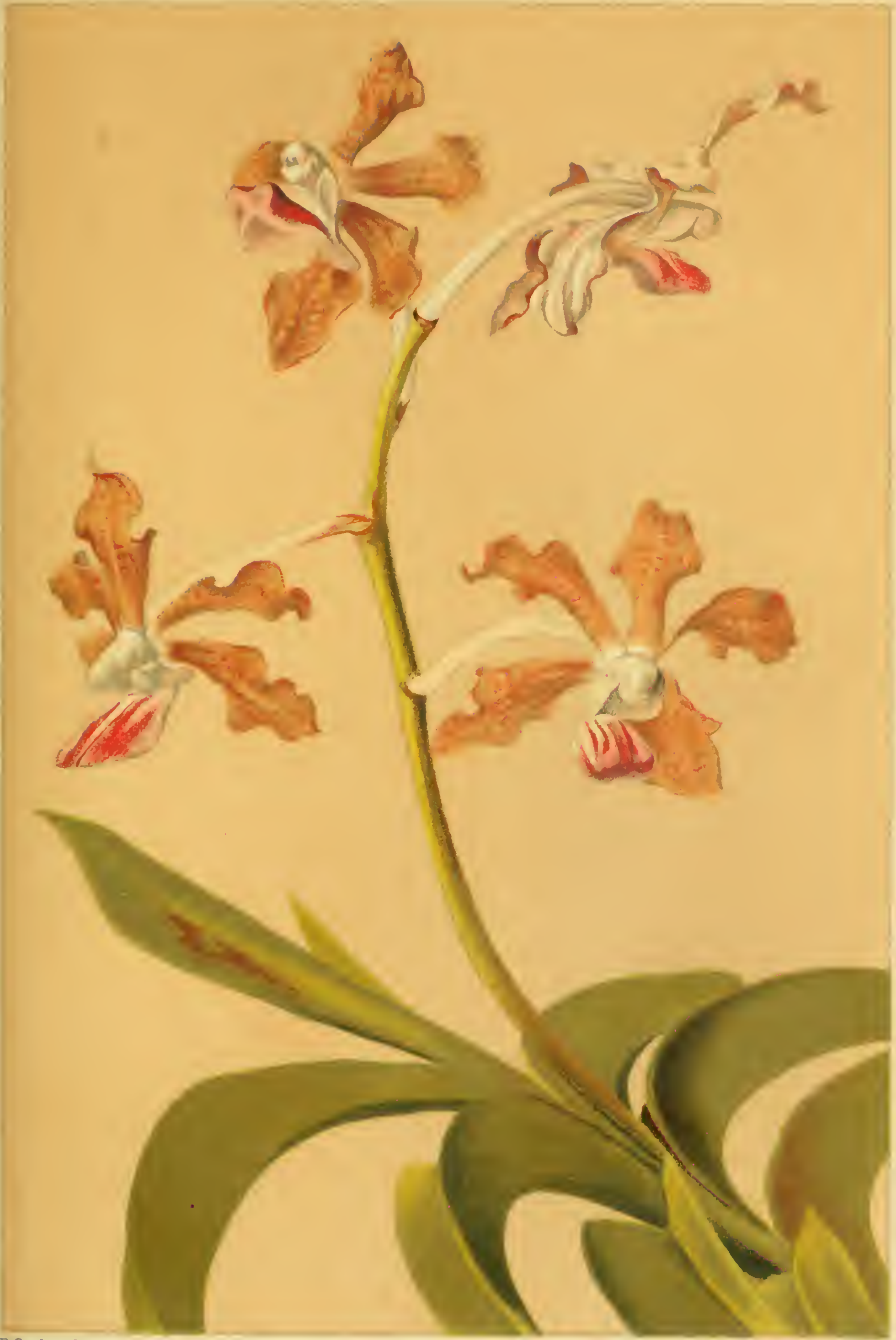
Stem 3 to 6 inches long, *flower* $\frac{2}{3}$ inch in diameter, *sepals* and *petals* yellow, *lip* pink.......................... 1. V. parviflora.

Stem 2 feet long, *flower* 2 inches in diameter, *sepals* and *petals* yellow with netted brown nerves, *lip* fiddle-shaped, violet.......................... 2. V. Roxburghii.

Stem 8 inches long, *flowers* as in 2, but *lip* white .... 2a. V. Roxburghii *var.* Spooneri.

1. Vanda parviflora, *Lindl.*; *Fl. Br. Ind., VI., p. 50* ; *T. Cooke, Fl. of Bombay, II, p. 703* ; Ærides Wightianum, *Lindl.*; *Dalz. and Gibs. p. 265.*

Stem stout, 3 to 6 inches long, invested with the brown bases of fallen leaves. *Leaves* 3 to 8 inches long, and $\frac{1}{2}$ inch broad, linear-oblong, folded, unequally 2-lobed at the tips. *Inflorescence* erect, arising from the axil below the first green leaf, shorter than or slightly exceeding the leaves, *bracts* $\frac{1}{12}$ inch long, ovate acute. *Flowers* $\frac{3}{4}$ inch in expanse, from 4 to 15, arranged on the upper half of the axis, *stalks* and *ovaries* $\frac{3}{4}$ inch long below, becoming shorter upwards ; *sepals* yellow, *dorsal* obovate, oblong, slightly longer than the *lateral* which are obovate ; *petals* yellow, spathulate oblong, about as long as the sepals ; *lip* white, suffused with pink, very short, *side-lobes* erect, ovate, dull pink with darker spots, *midlobe* shortly obovoid, *tip* dilated, retuse, disk with 2 fleshy, curved ridges, *spur* narrowly funnel-shaped, directed backwards, *column* short.



P Gerhardt del.

J. Green, Chromo

VANDA ROXBURGHII, Br.
(Life Size)

Flowers appear in May and June.

Distribution.—Throughout the Konkan, North Kanara, Western Ghats and hills of the Peninsula; Himalayas, eastwards from Kumaon to Assam, Burma, Ceylon.

2. VANDA ROXBURGHII, *Brown*: *Fl. Br. Ind., VI., p. 52*: *T. Cooke, Fl. of Bombay, II, p. 704.*

Stem stout, ultimately 2 feet long, rough with the bases of fallen leaves. *Leaves* 6 to 8 inches long, recurved, folded, thick, firm, gashed at the tip. *Peduncles* 6 to 8 inches long, each 6 to 10 flowered: *bracts* $\frac{1}{5}$ inch long, ovate acute: *stalk* and *ovary* about 2 inches long. *Flowers* about 2 inches in diameter; *sepals* and *petals* yellow, margins white, wavy, inner surface tessellated with brown, outer white suffused with brown, obovate *petals* a little shorter and narrower than *sepals*: *lip* fleshy, nearly as long as sepals, *side lobes* falcately lanceolate acute, creamy white, almost as long as column, *disk* convex, ridged, *midlobe* fiddle shaped, thick, violet, *tip* dilate, truncate, two-lobed; *spur* conical.

Flowers appear in June and July.

Distribution.—This, the common form of the species, is found throughout the plains of India, excepting in the North-West and tracts of scanty rainfall. It chiefly affects the branches of mango trees on which it often forms dense masses. It seems to be rare in the Bombay Presidency and Dalzell and Gibson do not include in their Flora. Mr. Spooner informs me that it is found in the Gir Hills of Kathiawar and also that it is common on *Mohwa* (Bassia latifolia) at Jhansi.

This gentleman discovered a variety in the hills of the Southern Mahratta Country which flowers from October to January, and this being sufficiently distinct I name and describe it now as:—

2*a*. V. ROXBURGHII, *Brown*, var. *nov.*, Spooneri.

Stems about 8 inches long, lower part invested by the persistent leathery sheaths of fallen leaves. *Leaves* yellowish-green, falcately oblong, erosely emarginate, so strongly folded that the margins are almost brought together, 4 inches long by 1 inch broad. *Inflorescence* about 6 inches long, *axis* strongly curved below the flowers of which there are usually 4; *bracts* short, blunt, amplexicaul; *stalk* and *ovary* $1\frac{1}{2}$ inch long. *Flowers* almost 2 inches in expanse; *sepals* and *petals* subequal, yellowish white behind, slightly keeled, *margins* only slightly waved, *inner surface* yellow with brown tessellations and suffusion; a white patch at the base of each sepal and petal; *lip* altogether white (excepting a yellow blotch at the base), thick, deeply concave on the lower half below ; *spur* short, blunt, directed backwards, *side lobes* small, ovate, *midlobe* ovate, deeply channelled down the centre, two-lobed at tip, mouth of spur yellow ; *Column* short, thick, pure white.

Flowers appear from October to January.

Distribution.—Belgaum and North Kanara Ghats. It is common between Londa and Tinai Ghat on the Western India Portuguese Railway and Mr. Proudlock of Ootacamund informed me that he has collected it in the Wynaad. T. Cooke does not refer to this variety, and I can find no evidence to show that it has ever been described from any part of India.

(*To be continued.*)

THE NESTING HABITS OF THE BAYA.

BY

D. DEWAR, F.Z.S., I.C.S.

Abundant though the Baya or Weaver-bird (*Ploceus baya*) is in this country, there are still certain points in its nesting habits that still require elucidation. It is with a view to gaining fresh knowledge on this most interesting point that I pen these lines. The matters to which I invite attention are : firstly the nature or *raison d'etre* of the so-called supplementary nests, secondly, the use of the lumps of clay found in many of the nests, and thirdly the fire-fly story.

Although I have served in three Provinces I have not yet resided in a locality where Bayas have been abundant ; indeed the only place at which I have had an opportunity of watching these birds at work was Lahore where the species is far from common. Thus it is that my observations do not throw very much light on the above-mentioned matters. There must, however, be a large number of members of this Society whose lives are cast in localities where Weaver-birds are numerous, and I trust that what follows will stimulate some, at any rate, of them to pay special attention to these matters and give the Society the benefit of their observations. Description of the nests is quite unnecessary, for they are among the most familiar objects of the Indian country-side.

The material out of which the nest is woven varies with the locality. In North India strands of long grass seem to be most generally used, in other parts of the country strips of cocoa-nut leaves or those of the date-palm or the banana are frequently utilised. Nests made of these latter materials are said to be less bulky than those woven out of grass since the fibres are much stronger.

As to the various grasses utilised, Major I. F. A. McNair writes as follows (p. 29 of Vol. IX of *Nature Notes*) : " The grass from which the Indian Baya builds his nest is usually the ' kusha ' or sacred grass of the Hindus, it is one of the *Poaceæ* and is known as the dog's-tail grass. In the Malayan Peninsula they weave together the young shoots of the ' lalang ' (*Gramen caricosum*) and sometimes what is called the ' buffalo ' grass and other fodder and pasture grasses. Under difficulties they have even been observed to strip into narrow shreds, the rigid leaves of the pine and sugarcane and the green leaves of the millet, the Indian Millet or *Sorghum vulgare*."

As to the *modus operandi*, I find in my note book the following observations made at Lahore in August 1907 I fear that they do not contain much that is new, but they were taken down on the spot, and so record actually what I saw.

" *Aug.* 24.—Came upon two Weaver-birds' nest high up in a tree—one of them complete except for the tubular entrance, and the other which is higher up in the tree, at the inverted basket or bell stage. At the latter a cock was working. From the former a pair of birds flew away, but did not return while I waited.

Aug. 25.—Again visited nests. With the upper one considerable progress had been made and the cock was working at it very hard. Every time he approached it, carrying material, he uttered cries of delight—not unmusical cries ; they might almost be called ' song '. Every now and again while working he would actually burst into song. He perched on the ' handle ' of the inverted basket and pushed the fibres he had brought in and out of the structure, sometimes perching on the outside to finish off the piece of weaving.

As soon as he had woven in his material he again shouted for joy, and then flew rapidly to a clump of tall (elephant) grass, that grows about 10 ft. high. The clump in question is about 50 yards from the tree in which the nest is situated. In about 2 minutes the bird returned with more material which he carried in his beak, holding it near one end so that it streamed behind him when he was flying.

In order to see how he tore off his material I quietly approached the clump and watched operations through my field glasses.

Having alighted on one of the nearly upright blades the Weaver-bird pecked at a neighbouring blade, gripping the edge with his beak. He then pulled or rather jerked his head away, giving several tugs. By this means the bird strips off a thin strand of grass. Holding this strand in his beak, he proceeds to strip off another ; then a third, and perhaps a fourth. He then flies off carrying the strands in his bill. Some at any rate of them, are not completely detached by the tearing process, but remain fixed to the grass blade by one end. The force with which the bird flies away suffices to complete the severance. Sometimes, however, the portion to be utilised does not come away so easily, the bird is pulled back, and may even hang for a little suspended from the blade of grass, but at the second or third attempt the Baya succeeds in completely severing the strand he has stripped off. Having watched this process for some time I walked up to the clump to examine the grass, and found it so thickly impregnated with silicon that I could have cut my hand with the edge of a blade. I found some strands that had been partly torn away evidently by the bird. I stripped these off and put them in my pocket. On my arrival at the bungalow I found some difficulty in extracting them, so closely did they cling to the lining owing to the large amount of silicon they contain. This material is thus well adapted for the purpose of weaving. When once it is threaded it will hold firmly together for an indefinite time.

Having pocketed these strands I returned to the tree and found a pair of Weaver-birds at the nearly completed nest, the hen inside and the cock outside. At the half completed nest the cock was working. Both cocks appeared much excited and were calling loudly. The former kept flapping his wings and every now and again attempted to perch on the half finished nest ; this was resented by the cock in possession and a squabble would ensue which would end in much noise and the flight of both cocks. In a few seconds each returned to his own nest.

There was a high wind blowing, so that while I watched the birds the nests were tossed about by the wind. Neither can have had any lumps of clay stuck on to them.

Thus both to-day and yesterday I had seen the two cocks and the one hen. Was the solitary cock a rejected suitor? I did not see the hen fetch any materials.

Aug. 26.—Both nests have progressed considerably. The passage of the lower one is nearly 3 inches long while in the upper one the egg-chamber is almost completed. There is now a hen at the upper nest and the cock to which it belongs is fearfully excited, he keeps singing and screaming, flapping his wings and snapping the mandibles of his bill, now jumping on to the nest, spreading his wings and singing, now poking with his beak at the hen who is inside the nest, now perching on a branch near by and flapping his wings. Every now and again he makes feints at the cock who is working at the lower nest. On two occasions he actually perched on that nest. This of course was more than the owner could tolerate and on each occasion led to a bit of fight. Once the cock of the upper nest actually had the effrontery to jump on to the back of the other cock. The fights are not of a very serious nature. The combatants close with one another, making a great noise, and then fly away pecking at each other, but they soon separate. Notwithstanding their frequent squabbles the cocks do the lion's share of nest building.

During the 40 minutes or so I have been watching the birds I have only seen each hen once at the nest, while each cock returned 7 or 8 times with weaving materials. The grass they use is impregnated with so much silicon that when once a strand has been pushed by the bird into the structure of the nest it is not easily pulled out again. So far as I can make out there is no clay in either nest.

Aug. 27.—The lower nest is practically completed and the cock is working away at another in the same tree (a mimosa in flower). The new nest being about 5 feet from the old one. The former is at present projecting horizontally from the branch and the "handle" or perch is already formed. After working a little at the new nest the cock returned to the old one, and put some finishing touches to it, poking it with his bill in various places. He then flew to a branch near the nest of the other cock (who was absent) and having looked at it for a little he flew to it and wrenched away with his beak one of the fibres that had been worked into it. This he transferred to his own nest! Four times did he visit his neighbour's nest and at each visit tear away a strand therefrom. Two of these strands he let fall, but the other two he utilised for his own nest. This behaviour seems to have been spiteful for he deliberately dropped two of the fibres he had wrenched away: moreover he attacked the part of the nest that was attached to the branch and thus weakened the foundations.

The other cock when he returned did not appear to notice anything amiss with his nest. While at work the cocks constantly twitter uttering chirrups somewhat resembling those of the house-sparrow. Occasionally they burst into song not unlike the call of the King Crow.

I watched the nests for half an hour, during which time neither hen put in an appearance.

August 28.—Saw both cocks at work, but neither hen.

August 30.—Saw both cocks at work, but neither hen.

The lower nest has now an entrance passage 9 inches long, the walls of this are much thinner than those of the rest of the nest. It is easy to see through them. The new nest is progressing but the upper one, belonging to the other cock, does not seem to have advanced much. I could see no signs of mud in the nests.

September 3.—Saw no signs of the weaver-birds.

The upper nest has disappeared. The new one has made a little progress. The owners appear to have deserted".

Let us now return to the matters in connection with the nest-building of the Baya, that need further elucidation.

The first is the meaning of the supplementary or " cock's " nests.

As regards these two theories have been advanced.

The first is that every pair of weaver-birds construct two nests—one in which the eggs are laid and one—an incomplete one—called by natives the *jhula*, in which the cock is supposed to sit and make a joyful noise for the delectation of his spouse. This is the popular theory and is held by all natives of India.

It is implicitly accepted by Major McNair, who writes, on page 28 of Vol. IX of *Nature Notes*, " The Bayas build two hanging nests quite separate and distinct ; one for the male which is open at the base, and has a grass perch for him to rest upon, the other for the female. . . ." Colonel Butler also says " there are two nests as a rule for each pair."

In this connection I may reproduce the following entry made at Lahore in my note-book : " Came upon a tree containing about 10 Weaver-bird's nests—complete ones—with as many ' cock's ' nests. None had any clay attached to the outside, but there were pellets of this material in three of which I could see the inside " As these were all disused nests, the fact that there were an equal number of supplementary nests appears to confirm the popular theory. Nevertheless there is as we shall see a good deal of evidence which tends to prove that two nests are not invariably made. Neither Jerdon, nor Hume, nor E. H. Aitken, nor Legge, nor Horne believe in the popular theory.

The second theory regarding these supplementary nests is that of Jerdon. That great ornithologist writes (Birds of India, Vol. II. page 343) : " It is generally believed that the unfinished nests are built by the male for his own special behoof and that the pieces of clay are more commonly found in it than in the complete nests.

I did not find this the case at Rangoon, where my opportunities of observing the bird were good and believe rather that the unfinished nests were either rejected from some imperfect construction weak support or other reason, if built early in the breeding season, or if late that they are simply the efforts of that constructive faculty which appears at this season to have such a powerful effect on this little bird and which causes some of them to go on building the long tubular entrance long after the hen is seated on her eggs."

Eha writes (p. 134 of *The Common Birds of Bombay*): "One thing certain is that for some reason or other the birds often get dissatisfied with the nest at this stage, and give it up and begin another. In every colony of nests there are several of these bells with a band across the mouth. In them the cock birds will sit in rainy weather, each chattering to his spouse as she broods on her eggs."

Mr. Horne, whose observations are recorded on pp. 117 and 118 of Vol. II of Hume's *Nests and Eggs of Indian Birds* tells of a palm tree from which "hung some thirty or forty of the elegantly formed nests of woven grass of the Baya bird." He does not mention seeing any supplementary nests among them; but adds to his description: "In some instances the male continues to build for amusement after the nest is finished, not only elongating the tubular entrance, but also making a kind of false nest."

Legge writes (*Birds of Ceylon*, p. 644): "Many nests are deserted when the body is being constructed, both before and after the loop has been formed and, this is, according to some writers, to furnish the male with a roosting place. This, I think, is an erroneous idea, the proportion of such nests is sometimes only 3 or 4 to a large colony; and it seems to me probable that they are rejected by the birds on account of some fault in their construction—the egg chamber too small, the neck not strong enough, or some such weak point."

The observations of Legge render it clear that every pair does not build two nests. But it seems equally clear that the uncompleted nests are not *all* ones that have been rejected on account of some fault.

In the case I have recorded above, the cock Baya did not commence his second nest until the first one had been practically completed. Moreover the cock, while working at the new nest, continued to add an occasional strand to the old one, thus showing that he had not rejected it. Thus although some nests may be rejected when half finished, it is I think evident that many of the supplementary nests are due to what Jerdon describes as an excess of the constructive faculty. All who are acquainted with Bayas living in an aviary know how strongly the nest-building instinct is rooted in the species.

The next point which requires elucidation is the meaning of the lumps of clay found in the nests.

As untenable suggestions we may cite that which says that the Baya uses them as whetstones on which to sharpen his beak, and that which declares their use is to hold the fire-flies stuck on them to illuminate the nest.

"It is," writes Jerdon, "at this stage of the work, from the formation of the loop to the time that the egg compartment is ready, that the lumps of clay are stuck on about which there are so many conflicting theories * * * From an observation of several nests, the times at which the clay was placed in the nests, and the position occupied, I am inclined to think that it is used to balance the nest correctly and to prevent its being blown about by the wind. In one nest recently examined there were about 3 ounces of clay in six different patches."

I think there can be little doubt that the object of the clay is to prevent the nest being blown about by the wind.

"From my own observation," writes Legge, "I find these lumps of clay are but seldom used in Ceylon, perhaps because the Bayas do not build during the windiest months of the year; and I have noticed that in a whole colony of nests built in a sheltered hill-side no clay was used."

McNair's statement that Baya's nests weigh from two to five ounces lends support to this view. The difference in weight must be largely due to the varying quantity of clay used; the more wind-swept the locality the more mud would be necessary to steady the nest.

The last point that remains to be decided is the truth or falsehood of the fire-fly story.

Natives believe that the Baya sticks fire-flies on these lumps of mud or clay. This story was inserted in Oliver Goldsmith's *Natural History* and from that has been copied into almost every popular book on birds.

Jerdon, Hume and E. H. Aitken all disbelieve the fire-fly story, and I must say that I agree with them.

In *Birds of the Plains* (p. 188) I wrote: "Sometime ago a correspondent living on the west coast of India informed me that Weaver-birds are very abundant in that part of the country, that their nests are everywhere to be seen, and that he had noticed fire-flies stuck into many of them. He asked if I could explain their presence. I suggested in reply that he had made a mistake and requested him to look carefully next nesting season, that is to say in August, and if he came upon a single nest on to which a fire-fly was stuck, to take it down, fire-flies and all, and send it to me at my expense. Since then August has come and gone thrice, and I have heard nothing from my correspondent!" I thought that this pretty effectively settled the fire-fly question, but unfortunately I have lost the address of the correspondent.

At the time of writing the above I had not seen Major McNair's second *Monograph of Ploceus baya* which appeared on page 46 of Vol. XIII (1902) of *Nature Notes*—The Magazine of the Selborne Club. McNair admits that although he has several nests with the mud, there is no sign of there having been any portion of an insect attached; but he quotes other evidence, which, if correct, would leave little room for doubt that the fire-fly story is true.

The first witness he quotes is "a Mr. Assistant Commissioner Buckley, of the Salt Revenue Department, who for many years has devoted himself to Natural History, and he writes from Marwar or Jodhpur, Rajputana, under dates February 21 and April 11, 1900: 'You, of course, know the shape of the breeding nest of these bayahs; besides the nest proper the male builds a 'jhoola' or swing for himself alongside this breeding nest. This 'jhoola' is about six inches long and open at the bottom, with a bar of worked grass from side to side to act as a perch on which he sits. In the 'jhoola' I have often found dabs of mud against the side *on which I have found fire-flies.* The natives say the male bird puts them there to light up his 'jhoola.' My own opinion is that he rather puts them in as a store of food for his mate, as generally the insects are so embedded in the mud as to be incapable of moving or emitting any phosphorescent light. Another thing, I have found small grubs and caterpillars in the mud of the 'jhoola,' which emit no phosphoric light, and which could only be imprisoned by the baya bird for food. The baya, as you know, is a grain-eater, but, like all grain-eating birds, feeds the young when just hatched on soft grubs and insects.'" The second witness brought forward by Major McNair is Captain Barry de Hamel of the Straits Settlement Police, who writes: "I have made fairly exhaustive enquiries into the question of the mud particles in the nest of the baya birds. My informants all seem decided as to one point, and that is, that the mud is really used to place fire-flies upon and I have met people who have actually seen them there. I have seen no one, however, who has ever found any other species of fly or insect within the nest. My informants are undecided, however, as to two points: the one party argue that the fly is used essentially as a lamp to guide the parent birds at nights: the other that it is a special delicacy for the youthful birds to fatten upon." Major McNair's third witness is another correspondent from Singapore, who writes: "One of Simon Coorozos' boys says that when at Tanjaig Katong a short time ago, he and some other boys found a weaver-bird's nest with three young ones, and also saw sticking in the mud three fire-flies."

Let us now consider for a little this evidence. That of Captain Barry de Hamel and of the correspondent from Singapore is, I submit, not worthy of acceptance inasmuch as it is hearsay only, and the hearsay of uneducated native witnesses who are notoriously untrustworthy. Men of science admit evidence far too freely and this accounts for some of the absurd theories which are generally accepted. Very little attempt appears to be made by the average zoologist to sift the various kinds of evidence submitted to him.

If a statement agrees with any theory he enunciates, he accepts it without scrutiny, but if it is opposed to his theory he ignores it, or accepts it and tries to explain it away! This, of course, is not the proper spirit in which to accept evidence. All evidence should be carefully sifted and scrutinised; in fact, the same tests should be applied to it as courts of law apply.

If we apply such tests to the evidence of the fire-fly theory, we are forced to reject the testimony of the two last of McNair's witnesses.

The evidence of Mr. Buckley is first-hand and should therefore be received. He states that he has found fire-flies on the mud in bayas' nests; but that these are generally so deeply embedded as to be incapable of moving or emitting any phosphorescent light. He further states that he has also found embedded in the mud non-phosphorescent insects.

Before this evidence can be said to afford any support of value to the fire-fly story it will be necessary for Mr. Buckley to answer the following questions. Did he himself take down the nests in question, and is he prepared to assert that the nests could not have been tampered with before he saw them? If Mr. Buckley's servants knew that the *Sahib* wanted a nest with fire-flies embedded in the mud it is quite likely that the more zealous of them would especially prepare nests for him. I would further like to ask whether it is not possible that the insects might not have been embedded in the mud before the baya took it to the nest?

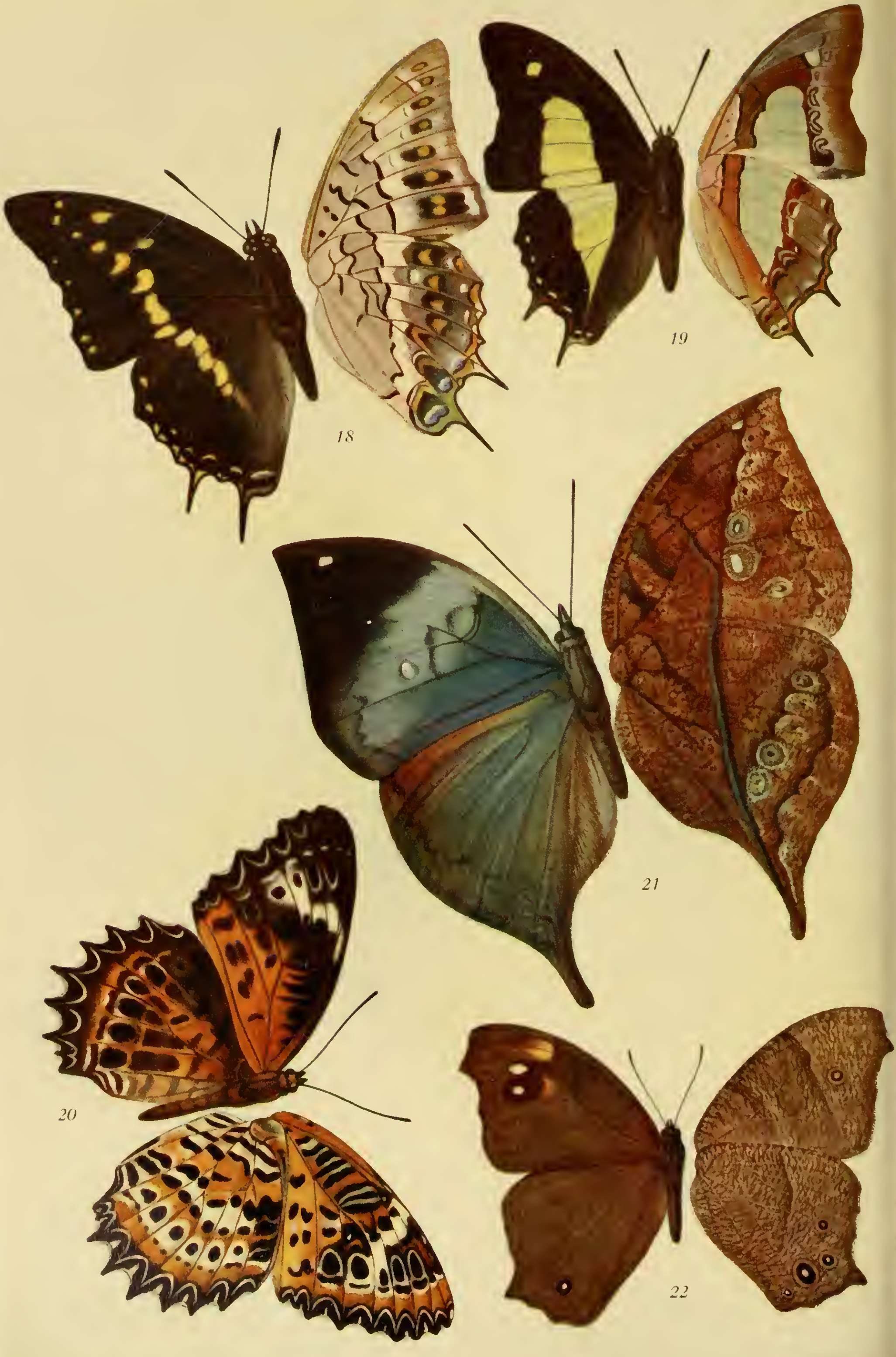
I would point out that it is most unlikely that the cock bird should take the trouble to store 2 or 3 insects by sticking them on to the mud when a few minutes' search for them would suffice to enable him to procure them when they were actually needed. Moreover, if the insects in question were merely stored temporarily, it seems unlikely that the cock bird should force them in the mud to such a depth that they would be incapable of emitting their phosphorescent light!

Further, Mr. Buckley's statement does not explain, or, indeed, throw any light upon, the story so universal among natives both in India and the Malay Peninsula, that the Baya bird lights up its nest.

Now, while we should be very cautious about accepting statements of uneducated witnesses, it seems true that there must be some foundation for a story so universal, and one in the telling of which the teller has no particular interest.

As I have already said, I do not believe that weaver-birds' nests are ever lighted up by phosphorescent creatures. My suggestion is that the baya brings the clay to the nest in its bill in a moist condition. Now wet clay retains moisture for some time and would shine brightly in the moonlight, so might easily be mistaken for phosphorescence. The only evidence in support of this suggestion that I can adduce is the fact, of which I have satisfied myself, that the egg-cells made by solitary wasps shine when the clay that composes them is wet. In a large Society like this one there must be numbers of members in a position to make first-hand observations on the nesting habits of the baya, and now that the points which require elucidation have been distinctly stated, I trust that efforts will be made to throw further light on them. It should be remembered that as regards the fire-fly story purely negative evidence is valuable, indeed it is the only kind that I expect to be sent in.

PLATE D.



THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del.

Hentschel-Colourty

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

EXPLANATION OF PLATE D.

FIG. 18.—*Charaxes fabius*, ♂.

,, 19.—*Eulepis athamas*, ♂.

,, 20.—*Cethosia mahratta*, ♂.

,, 21.—*Kallima horsfieldii*, ♂.

,, 22.—*Melanitis ismene*, ♂.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I. F. S.

(With Plates D and II.)

(Continued from page 438 of this Volume.)

SUB-FAMILY—*NYMPHALINÆ.*

A. Costa of forewing serrated.
  a. Cell of both fore and hindwings closed .... *Charaxes.*
  b. Cell of forewing only closed .... *Eulepis.*

An "open" cell means the absence of discocellular nervules. The above two genera can be seperated, for our purposes, by *Eulepis* having a broad white or yellow fascia across *both* wings which the other has not.

B. Costa of forewing not serrated.
  a. Cell of both fore and hindwing closed.
    a^1. Eyes hairy.. *Vanessa.*
    b^1. Eyes naked.
      a^2. Vein 12 of forewing not swollen at base.
        a^3. Forewing vein 3 from before end of the cell, vein 4 from the end.
          a^4. Both wings above tawny spotted black. *Argynnis.*
          b^4. Both wings above black with white marks, or tawny without spots .... *Hypolimnas.*

The female of *Hypolimnas misippus* only is tawny and is a mimic of *Danais chrysippus*, white apical band and all, but may be at once distinguished from it by having only one black spot on the discocellulars of hindwing on the underside instead of three as in *Danais.*

        b^3. Forewing with veins 3, 4 from lower angle of cell.
          a^4. Hindwing with veins 3, 4 from lower angle of cell.
            a^5. Ground colour green...................... *Dophla.*
            b^5. Ground-colour tawny, or whitish.
              a^6. Hindwing outer margin not scalloped only slightly waved ; exp. 2″-2·5″ .... *Atella.*
              b^6. Hindwing outer margin deeply scalloped between veins ; exp. 3″-4″.................................. *Cethosia.*

The female of *Cethosia cyane* is greenish-white with black markings like in the male.

b^4. Hindwing with veins 3, 4 stalked.
  a^5. Ground-colour green .... *Kallima.*
  b^5. Ground-colour white .... *Cyrestis.*
b^2. Vein 12 of forewings swollen at base.
  a^3. Upperside tawny with submarginal black band to hindwing .... *Byblia*
  b^1. Upperside : brownish tawny with several series of dark crenulate lines parallel to outer margin of hindwing .... *Ergolis.*
b. Cell of forewing closed, of hindwing open.

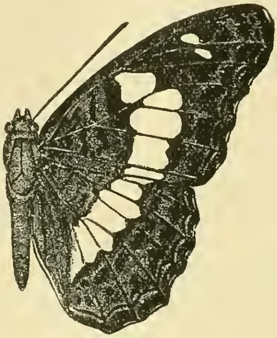


Fig. 9.

Moduza procis, showing band.

a^1. Colour of upperside : rich ferruginous-red with broad white band of spots from after middle of costa of forewing to above anal angle of hindwing .... *Moduza.*

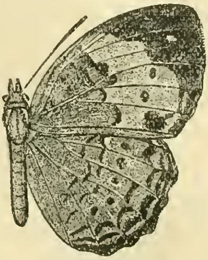


Fig. 10.

Cufa phacida, showing band.

b^1. Colour upperside pale brownish-tawny with a broad yellow discal band from costa to vein 1 of forewing .... *Cupha.*
c^1. Colour of upperside tawny without band...... *Cirrochroa.*

c. Cell of both wings open.

*a*¹. Wings upperside : black, banded white or tawny.

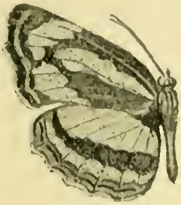


Fig. 11.

Rahinda hordonia, showing bands.

*a*². Wings upperside : banded black and tawny. *Rahinda.*

*b*². Wings upperside : banded black and white.

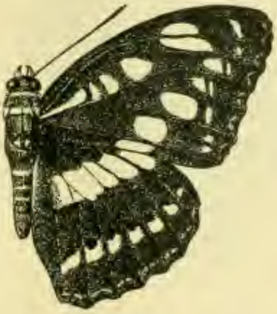


Fig. 12.

Athyma perius, showing bands, row of jet-black spots.

*a*³. Hindwing underside : a row of jet-black spots on inner edge of postdiscal macular white band .... *Athyma.*

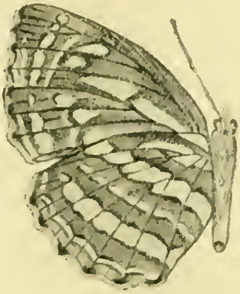


Fig. 13.

Neptis cunyome, showing bands and spots.

*b*³. Hindwing underside : with no such spots. *Neptis.*

*b*¹. Wings upperside : streaked and spotted white and black.. *Euripus.*

- c^1. Wings upperside : neither banded nor streaked.
  - a^2. Forewing upperside : at least three preapical dots, one below the other ; male uniform black, above female ; tawny ; exp. under 2″ .... *Apatura.*
  - b^2. Forewing upperside : no preapical white dots ; exp. over 2″.
    - a^3. Forewing with an ocellus always present between veins 2 and 3, at least on the underside ; exp. 2″-2·75″ .... *Junonia.*

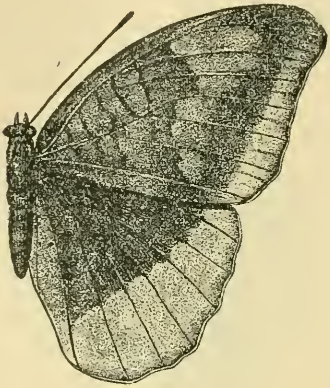


Fig. 14.

Euthalia lepidca, showing absence of oceilus ; for occillus present *vide* Pl. A., figs. 2, 3, 4, 5, 6.

- b^3. Forewing with no occillus ; exp. 2.″ 75-3″ 3·3″ .... *Euthalia.*

Dophla and *Euthalia* are very closely allied ; the larvæ and pupæ being of the same type : the former with long feathered lateral processes, the latter being pyramidal in shape.

The larvæ of *Vanessa*, *Junonia*, *Kallima*, *Hypolimnas* and *Cethosia* are all spined ; the pupæ are elongate and more or less circular in transverse section with a tuberculate surface. *Ergolis* and *Byblia* are slightly different from these, *Cupha* and *Atella* somewhat from all, while *Rahinda* and *Neptis* are hardly spined in the proper sense of the word, though evidently related to the type.

The larva of *Apatura* and *Euripus* is naked with a two-horned head and tail-points ; the pupa is carinated dorsally and elongated.

The larva of *Charaxes* and *Eulapis* has four horns to the head and hardly any tail-points : the pupa is short, stont and smooth.

Genus—CHARAXES.

A. Colour upperside: tawny with broad black marginal border (male) or with a broad white discal band to forewing besides (female). Exp. 3·6″-4·3″. *imna.*

B. Colour upperside: black with a discal band on forewing of well separated yellow spots. Exp. 3·2″ to 3·7″ .... *fabius.*

Genus—EULEPIS.

A. Colour upperside: black with a broad, pale yellow transverse discal band from middle of forewing to near inner margin of hindwing with a spot or two of the same colour above it towards apex of forewing. Exp. 2·5″ to 3·25″ .... *athamas.*

B. Similar, only the band pure white bordered by smalt-blue on the outer side; the underside very prettily variegated. Exp. 3·6″ to 4·5″ .... *schreiberi.*

Both these genera have the species with veins 1 and 3 of the hindwing produced into longish triangular tails, more pointed in the male than in the female. *C. fabius* is a plain country species commonly, *E. athamas* less so, the other two not at all.

Genus—APATURA.

Only one species. Exp. 1·8″ to 2″ .... *camiba.*

This is not a plain butterfly but may be obtained at Matheran or Mahableshwar or even along the Thana Hills.

Genus—EURIPUS.

Only one species. Exp. 2·7″ to 3·5″ .... *consimilis*

This is not a common insect anywhere and is probably confined altogether to the damper hill tracts of the Western Ghat in Bombay Presidency. The foodplant of the larva is *Trema orientalis*, Blume, a small tree that springs up in forest land that has been cleared of growth and burnt; it grows rapidly and is short-lived, rather like a *Grewia* to look at. The female is larger than the male.

Genus—DOPHLA.

Only one species. Exp. 3·4′ to 4·3″ .... *laudabilis.*

This is really a hill species and might possibly be found at Matheran or Mahableshwar as the foodplant of its larva is *Diospyros candolleana*, a small species of Ebony growing in the evergreen forests of the Western Ghats. The female is larger than the male and has a chalky-white discal band across the forewing, wanting in the male. It is really a *Euthalia* by habit and larva and pupa.

Genus—EUTHALIA.

A.	Colour dark brown with a broad grey margin to hindwing, the female paler. Exp. 2·75″—3·1″	*lepidea.*
B.	Colour deep brownish-green with crimson and white markings, the white in the female being a broad transverse discal band on forewing from middle of costa to tornal angle. Exp. 2·7″—3·3″	*lubentine.*
C.	Colour olivaceous brown or green (in fresh specimens) with no crimson on upperside. Exp. 2·6″—3·1″	*garuda.*
D.	Colour tawny with black markings. Exp. 2·20″—2·75″	*nais.*

E. lepidea is not to be met with in the plains. It may possibly be obtained along the hills in Thana. The foodplant of its larvæ is commonly *Butea frondosa*, Roxb., known as "Flame of the Forest." Another foodplant is *Melastoma malabathricum*, L.

Genus—MODUZA.

Only one species. Exp. 2·5″—3″ .... *procris.*

Is a hill species affecting jungles. May possibly be met with in Thana along the hills. The larva feeds upon the rubiaceous *Wendlandia exserta*, D. C., *Mussoenda frondosa*, L., the common scandent shrub, a semi-creeper, with little orange-red tubular flowers and large, pure white calyx-leaf and the large tree *Stephegyne parvifolia*, Korth.

Genus—ATHYMA.

Only one species. Exp. 2·4″—3″ .... *perius.*

Will occur everywhere except in desert places such as Sind. It much resembles a *Neptis* in flight and facies but is stronger and larger. The genus *Pantoporia* very closely allied, has three species, occurring in the Western Ghats: *P. inara* with the male banded black and white and a blur of red at apex of forewing on upperside, the female banded tawny and black like a *Rahinda*; *P. ranga* with both sexes banded black and white and the eyes hairy; *P. selenophora* with both sexes black, banded with white, the underside chestnut-red and white while in *P. ranga* it is dark-brown, black and white.

Genus—RAHINDA.

Only one species. Exp. 1·5″—2·1″ .... *hordonia.*

Found nearly everywhere in India. The larva feeds upon climbing *Acacia* of different species.

Genus—NEPTIS.

A. Hindwing underside: transverse subbasal band and postdiscal series of spots always more or less margined with black. Exp. 1·75″—2·8″ ... . *eurynome.*

B. Hindwing underside: this band and spots not margined with black—

a. Underside hindwing: a round dark spot in the cell. Exp. 2·5″—2·75″ .... *jumbah.*

b. Underside hindwing: no dark spot in cell. Exp. 2·5″—3 .... *columella.*

N. eurynome will be found everywhere except in desert places; its larva feeds upon the leaves of wild pea. *N. jumbah* is more of a hill species but is not rare: its larva feeds upon a great many different plants. *N. columella* is a hill species restricted to forest areas but has been taken at Mahableshwar and will probably be found at Matheran and in Thana: its larva feeds upon *Leguminoseæ.* There is another species occuring in Kanara: *N. hampsoni* which is very like *N. eurynome* except that the bands are not margined with black; and differs from *N. columella* in the subbasal white band of hindwing extending to the costal margin: and from *N. jumbah* in wanting the spot in cell on underside of the hindwing; its larva feeds on *Trema orientalis*, Blume, as a rule. According to the key of genera all our *Neptis* are banded black and white. But there is one species found in the Kanara Ghats which is banded black and tawny like a *Rahinda* from which it may be distinguished at once, however, by the underside not being striated. It can be separated from *Pantoporia inara*, the female of which is the only other insect it might be mistaken for, by the cell of both fore and hindwing being open while in the genus *Pantoporia* the cell of the hindwing only is open. This tawny and black-banded species is *N. viraja* and its larva feeds on *Dalbergia volubilis,* Roxb., a climbing species of Blackwood.

Genus—CYRESTIS.

Only one species. Exp. 2·25″—2·75″ .... *thyodamas.*

This insect is commonly known as the Map-Butterfly: it is found everywhere in the hills where the climate is not too dry and along the coast south of Bombay. The larva and pupa are abormal in shape and the food plant is the common Banyan tree (*Ficus indica*, L.).

Genus—JUNONIA.

A.	Colour upperside : dark sepia-brown with darker markings, without distinct ocelli of any sort. Exp. 2·25″	*iphita.*
B.	Colour upperside : olive-brown with ocelli. Exp. 2·25″—2·5″	*lemonias.*
C.	Colour upperside : grey with narrow black bands and orange and black ocelli on the outer area. Exp. 2·35″—2·75″	*atlites.*
D.	Colour upperside : velvety-black and blue and apical ochreous patch. Exp. 2·2″—2·5″	*orithya.*
E.	Colour upperside : bright yellow, apex of forewing jet-black as well as inner margin ; base of hindwing with blue patch. Exp. 2·25″	*hierta.*
F.	Colour upperside : tawny with large ocelli on both wings. Exp. 2·i″—2·4″	*almana.*

The *Junonias* are about the commonest of all our butterflies and are found everywhere in the plains and hills. The two first species are perhaps more plentiful in the hills than elsewhere. The larvæ and pupæ are all very similar to each other and the former all feed upon plants of the family *Acanthaceæ.*

Genus—VANESSA.

A.	Hindwing upperside : with terminal half more or less ochraceous or orange-yellow. Exp. 2·2″—2·75″	*cardui.*
B.	Hindwing upperside : with terminal margin only and a postdiscal band confluent with it orange-yellow. Exp. 2·3″—2·75″	*indica.*

V. *cardui* is the Painted Lady of England and is spread throughout the old world. *A. indica* is the eastern representative of the English Red Admiral : it is generally confined to the hills though sporadically occurring in the plain country. The larvæ and pupæ of the two species are very similar ; the larva of the first species feeding on many things, as for example, thistles and *Zornia diphylla,* Pers., a small legumionoseous weed growing plentifully near the seashore in Bombay.

Genus—HYPOLIMNAS.

A.	Upperside black, fore and hindwing with a post discal series of white spots always present. Exp. male : 3″—4″, female : 3·5″—4·5″	*bolina.*

B. Upperside of male black, both wings without the postdiscal series of spots; of female tawny (mimics *D. chrysippus*) Exp. 2·75″—3·6″...... *misippus.*

Both these species occur throughout India in the hills and in the plains and the male of the first cannot fail to attract attention by reason of the brilliant dark-blue reflections on the disc of the wings and its habit of resting on low shrubs in the sun. The females are larger and have much less blue on their wings which, consequently perhaps, they expose much less; they may generally be seen flying close to the ground or walking about on the earth for the purpose of depositing their eggs upon the low-growing *Acanthaceæ* which come up so plentifully everywhere in India after the slightest fall of rain. The females often fly into the verandahs of bungalows and settle on the rafters with their wings closed. *H. misippus* is somewhat "wilder" than the other although it is perhaps the more abundant in cultivated country. Its female mimics *Danais chrysippus* and has a form, like the variety *D. dorippus*, without the white apical band to the forewing. While the foodplants of *H. bolina* are acanthaceous, the larva of *H. misippus* feeds upon *Portulaca oleracea*, the "Common Purslane" of England, cultivated as a vegetable in India as well as in other parts of the world and commonly growing wild too. The larvæ and pupæ of the two species are very similar, the former spined and horned.

Genus—KALLIMA.

Only one species. Exp. 3·3″—4·75″ .... *horsfieldii.*

This is the Leaf Butterfly. It is a hill species but will be found in Thana, at Matheran and Mahableshwar.

There is a "Red Kallima" found in the hills of Southern India (also in the Himalayas) the name of which is *Doleschallia bisaltide* which may possibly turn up at Matheran or Mahableshwar. It has the wings shaped as in *Kallima*, but the upperside is tawny instead of green, there is a narrow black preapical band instead of the white one and the apex is black; the underside has the fascia from apex of forewing to the tornal angle of hindwing. It has no very pronounced seasonal difference of form.

Genus—CETHOSIA.

A. A few or no black spots in interspaces beyond apex of cell on upperside of hindwing. Exp. 3·55″—3·9″ .... *cyane.*

B. Broad black streaks followed by a series of large oval spots in interspaces beyond apex of cell on upperside of hindwing. Exp. 2·85″—3·95″ ... *mahratta.*

C. mahratta is southern, *C. cyane* northern and eastern. The larvæ are gregarious, black in colour, banded with crimson and yellow and feed upon wild Passion-Plant, *Modecca palmata*, Lam., and upon cultivated *Passiflorae* too no doubt; they are spined and horned. Neither of the species will be found in very dry regions.

Genus—ATELLA.

Only one species. Exp. 2″—2·5″ .... *phalantha.*

The butterfly is fairly plentiful everywhere; the larva is spined without horns and feed upon *Flacourtia.* There is another species, very local in Kanara District, called *A. alcippe*, which is smaller than this and can be distinguished from it by having four transverse lines across cell of forewing in addition to the black line on the discocellulars instead of three transverse black lines and the discocellular one. Its larva feeds upon the violaceous *Alsodeia zeylanica*, Thw.

Genus—CUPHA.

Only one species. Exp. 2·3″—3″........................... *placida.*

This is really a butterfly of the forests and hills, not of the plains. It is common in Kanara and may probably occur at Matheran or Mahableshwar. The larva is like that of *Atella* and feeds upon the same plant.

Genus—ARGYNNIS.

Only one species. Exp. 3·25″—3·8″ .... *hyperbious.*

This was formerly known as *A. niphe*, L. The form *A. castetsi*, Obert, is said to be found in the plains of Southern India. Its larva is spined and feeds on Violets.

Genus—CIRROCHROA.

A. Forewing underside: discal band of even width throughout. Exp. 2·5″—3·25″................... *mithila.*

B. Forewing underside: discal band narrowing at both ends. Exp. 2·5″—3″ .... *thais.*

These are both hill species. The first was taken at Lucknow; the second may possibly occur at Matheran or Mahableshwar. The larvæ are spined and that of *C. thais* feeds upon *Hydnocarpus wightiana*, Blume.

Genus—BYBLIA.

Only one species. Exp. 2″—2·25″............................ *ilithyia.*

The insect is not found on the coasts. The larva and pupa are very like those of the next genus and the foodplant is the same.

Genus—ERGOLIS.

A. Forewing: termen (outer margin) deeply concave between veins 5 and 6 and 5 and 3. Exp. 2″—2·25″ .... *ariadne.*

B. Forewing: termen not concave there, but somewhat sinuous.

  a. Hindwing underside: male, without central dark patch; upperside: female, brownish-ochreous. Exp. 2′—2·4″ .... *merione.*

  b. Hindwing underside: male, with central dark patch; upperside: in both sexes dark ferruginous. Exp. 1·9″—2·2″ .... *taprobana.*

The males of *ariadne* have the upper three veins of the hindwing (veins 6, 7 and 8) on the upperside white. *E. taprobana* is the southern representative of *E. marione* in India. The larvæ are spined and have horns, the pupæ are slender with the dorsal margins of wings curved, the thorax humped and transverse ridges across abdominal dorsum. The foodplant is the euphorbiaceous *Tragia involucrata*, which is a weak creeper with a leaf somewhat like a nettle, common in hedges.

This next subfamily of the *Nymphalinæ* is one of the largest groups of Butterflies in the number of species it contains; it is equivalent in this respect to the whole family of Skippers or of the *Lycænidæ*. It is distributed as the predominant group throughout the whole world. In British India there are some 220 species of which only some two score will interest us more particularly. In Great Britain 18 species occur among which are included the Painted Lady, the Red Admiral, the Camberwell Beauty, the Tortoise Shells, the Peacock, the Fritilleries and the Purple Emperor. In the coloured plates A, B, C, D and E, figures 1-21 and 36 are represented 22 species of Indian insects; their names will be found in the " List of contents of the Plates."

These butterflies are all fond of the sun; at least this is true of the males, for some of the females are not often seen except under cover. Some have the habit of basking on the tops of trees, perched on a leaf, during the heat of the day, occasionally taking a short flight to return to the same spot; these are generally the aristocracy: the largest and most powerful insects of the group; they do not frequent flowers but nourish themselves on the saps of trees and fruits. Such are *Charaxes* and *Eulepis*, *Euthalia*, *Pantoporia* and *Apatura*. Others, weaker of flight, hardly ever rise beyond the bushes and small trees, a story lower down, where they enjoy the sun, basking on leaves in the same way. *Neptis*, *Atella*, *Cupha*, *Ergolis* are some of these; they visit flowers, but in a desultory way. A third section, consisting of such insects as *Vanessa*, *Junonia*, *Hypolimnas* inhabit the ground floor and prefer sunning themselves sitting on a bare patch of earth or on the leaf of a creeping plant. These last are, notwithstanding their lowly habits, very strong and quick on the wing and often rise to considerable heights in the air in prolonged flight; they are the commonest of the Nymphalines of the plain country and are often seen at flowers; the foodplants of their larvæ are low herbaceous weeds and plants that exist throughout wide areas and have been extensively spread by cultivation. The weakest fliers are *Byblia* and *Ergolis* with vein 12 of the forewing swollen at the base, *Cupha* and *Neptis*. The style of flight is various, differing with the group the butterfly belongs to. *Charaxes* has a flight like *Discophora lepida*: a succession of powerful skips or jerks up and down, the wings being brought to meet over the back between each; it basks with wings completely closed or very slightly opened. *Vanessa*, *Junonia*, &c., have a similar but less powerful flight, the wings being moved much faster and never brought to meet completely over the back between the strokes; in basking these are held half open, fully displaying the colour and pattern of the upperside, which is hardly ever the case with *Charaxes*. *Byblia*, *Cupha* and *Ergolis* have a flight like *Junonia* but much weaker, and bask similarly or even with the wings completely open. *Euthalia*, *Athyma*, *Neptis*, *Moduza*, *Cyrestis* always hold the wings horizontal or inclined downwards slightly in flight, sailing along between each stroke with them in the latter position, moving them little above the horizontal at any time; they bask with them wide open though, like all butterflies except some Skippers, they will close them altogether in dull weather or in rain.

Basking butterflies are nearly always found to be males. The females have work to do and confine their attention altogether to the doing of it: the laying of the eggs after fertilisation. In the jungles the females of many species are hardly ever seen and especially is this true of the basking sorts. They hide in the thick places and only venture into the open along the edges, their purpose in life being to keep alive until the eggs have all been disposed of; and they rest in a safe place when not engaged in laying with that object in view; while the male enjoys the sun and the short life vouchsafed him having nothing to do but eat, drink and be merry. In artificial breeding it has been found that as many or even more females are produced as males, and there is no reason to suppose that it should be any different outside under natural conditions—that the female ranks should be thinned by enemies more than those of the male.

Nearly every genus has a different facies, a different style of pattern and marking; few are alike. The subfamily, indeed, to judge by the earlier stages of the forms, appears to be composed of more heterogenous parts than any other whole family. Certain genera are probably further apart than *Telchinia* of the *Acraeinæ* and *Vanessa* judged by that criterion; or than the *Morphinæ* and *Charaxes*, *Apatura* &c. *Cyrestis* and *Dophla* are widely separated from *Kallima*, *Hypolimnas*, &c. The predominating ground-colour is, perhaps, tawny, which is variegated with black; blacks and greens and browns are met with, white is scarce. Some of the insects are banded horizontally or vertically, many of them are spotted, while others have the colouration arranged in patches. The undersides are almost invariably different from the upper in pattern, and often in colour. The males differ from the females in some cases in colouration as in *Apatura* with a black male and tawny female and in *Hypolimnas* where the respective colours are also black and tawny.

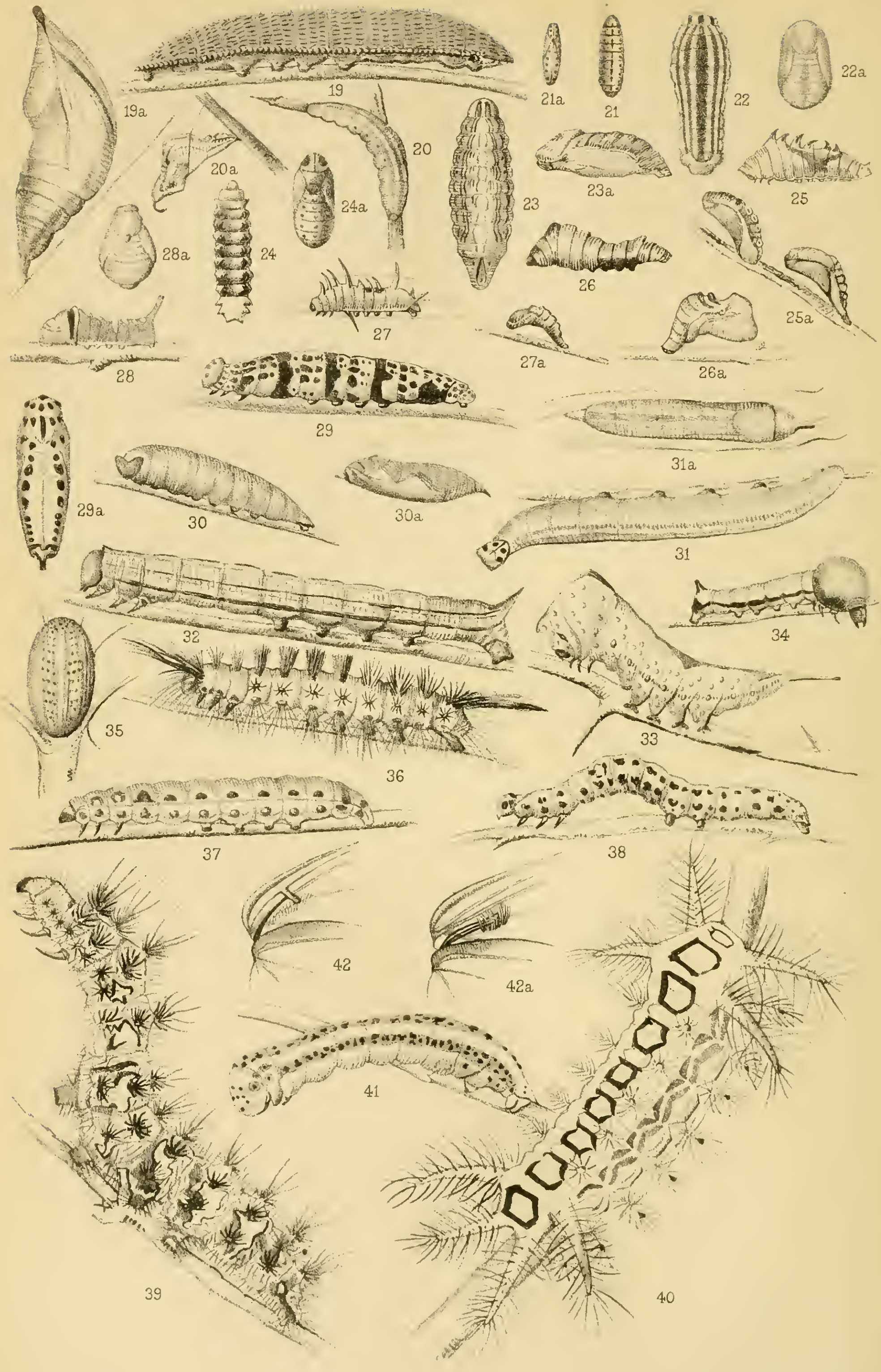
The Nymphaline egg is as variable as the types of insects and cannot be described under a single head. *Euthalia*, *Charexes* have it lower than broad, hardly ridged; in the rest it is higher than broad and generally ridged, pitted or knobbed; in *Cyrestis* it is abnormal in having a lid through which the larva emerges.

We may take the true type of nymphaline caterpillar as having a cylindrical body with each segment set with spines including the well-separated head and a rounded anal end such as we find in the genera *Vanessa*, *Argynnis*, *Junonia*, *Hypolimnas* (*vide* Pl. I, fig. 11),

&c., with all the spines of more or less equal length and branched, the first two segments often having them reduced to tubercles or even, occasionally, the head being quite smooth. Slight departures from the type are *Athyma* and *Pantoporia* (*vide* Pl. I, fig. 10) larvæ with some spines more developed than others. In *Moduza* these spines have a tendency to broaden out and become fleshy and in *Neptis* all are soft, some segments being without any. The pupæ of all the spined larvæ are elongated, provided with more or less developed head-points and surface set with small conical tubercles, which are rarely absent but are occasionally developed into flattened expansions. *Euthalia* has an aberrant larva (*vide* Pl. I, fig. 6), smooth except for long, laterally extended, supraspiracular fleshy processes, all feathered: the pupa is angular and smooth, with head-points. *Charaxes* (*vide* Pl. I, fig. 4) and *Apatura* (*vide* Pl. I, fig. 5) have altogether naked larvæ with horns on the head and more or less developed tail-points; the pupa of the former is smooth, stout, short without head-points; of the latter elongate, compressed, dorsally carinated, with head-points. *Cyrestis* (*vide* Pl. I, fig. 7) is very abnormal: naked except for a long dorsal process on segments 6 and 12, with a horned head; the pupa elongate with dorsal process and long head-point. The various larvæ can be classified as under:—

A. Larvæ with naked bodies; head large, rather flat and provided with well developed horns; last segment with more or less well-developed tail-points.
  a. Head with four horns. The tail-points are short, stout, blunt and widely separated. Pupa short, quite smooth, stout: stoutest at segment 7 .... Gen. *Eulepis* and *Charaxes*.
    a^1. Body green, striped diagonally with white... *Eul. athamas.*
    b^1. Body green with a well defined dorsal mark on segment 7 or not.
      a^2. Head with four horns of equal length.
        a^3. Dorsal mark on segment 7 crescent-shaped, white .... *Eul. schreiberi.*
        b^3. Dorsal mark on segment 7 semi circular soiled white ... . *Ch. imna.*
      b^2. Head with middle horns much longer than the outer ones, dorsal mark very often absent or nearly so, generally small ...... *Ch. fabius.*

Plate II.


19
19a
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20a
21a
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24a
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26a
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28a
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29a
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30a
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31a
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42a

E. C. Knight lith.
West, Newman imp.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

EXPLANATION OF PLATE II.

(All butterfly larvæ.)

Fig. 19 and 19*a*	Larva and pupa of	*Hebomoia australis*, Butler.
,, 20 and 20*a*	,, ,,	*Colotis etrida*, Boisduval.
,, 21 and 21*a*	,, ,,	*Catochrysops cnejus*, Fabr.
,, 22 and 22*a*	,, ,,	*Amblypodia anita*, Hewitson.
,, 23 and 23*a*	,, ,,	*Arhopala amantes*, Hewitson.
,, 24 and 24*a*	,, ,,	*Rapala melampus*, Cramer.
,, 25 and 25*a*	,, ,,	*Cheritra jaffra*, Butler
,, 26 and 26*a*	,, ,,	*Tajuria cippus*, Fabr.
,, 27 and 27*a*	,, ,,	*Rathinda amor*, Fabr.
,, 28 and 28*a*	,, ,,	*Curetis thetis*, Drury.
,, 29 and 29*a*	,, ,,	*Ismene gomata*, Moore.
,, 30 and 30*a*	,, ,,	*Tagiades atticus*, Fabr.
,, 31 and 31*a*	,, ,,	*Baoris conjuncta*, Herrich-Schaeffer.

Fig. 32	Larva of	*Leucophlebia emittens*, Wlk.
,, 33	,,	*Cerur liturata*, Wlk.
,, 34	,,	*Pseudelydna rufoflava*, Wlk.
,, 35	,,	*Belippa lohor*, Moore.
,, 36	,,	*Orgyia gonostigma* (English).
,, 37	,,	*Prodenia littoralis*, Boisd.
,, 38	,,	*Ophiusa onelia*, Guen.
,, 39	,,	*Loepa katinka*, Westw.
,, 40	,,	*Natada velutina*, Koll.
,, 41	,,	*Euschema percota*, Swinh.
,, 42 and 42*a*	Male and Female retinaculum (*r*) and frenulum (*f*) of the moth *Rhodogastria astreas*.	

[*The explanation of Plate I (Larvæ) will be published in the Index Number of this Volume.*]

b. Head with two horns. The tail-points longer, sharp and closer together. Pupa longer, laterally compressed, dorsally keeled and with head-points..Gen. *Apatura* and *Euripus.*

a^1. Colour of larva yellow .... *Apatura camiba.*

b^1. Colour of larva green .... *Euripus consimilis.*

B. Larvæ with fleshy processes on segments 6 and 12, one dorsal one to each, somewhat horny : surface otherwise naked ; the head provided with two horns. Pupa angular with a flattened dorsal process on segments 5-8 and a good deal compressed ; head produced into a curved snout .... *Cyrestis thyodamas.*

C. Larvæ with subdorsal fleshy process or turbercles or points on one or more of segments 3, 4, 6, 7, 8, 12.. Gen. *Neptis, Rahinda*

a. A low ridge across segment 4 only, ending in a blunt, small point ; anal segment short, thick, conical ; head vertex quite smooth............... *Neptis viraja.*

b. Segments 3, 4, 6, 12 with short subdorsal points ; head quite smooth .... *Rahinda hordonia.*

c. Segments 3, 4, 6, 12 with longer sharp points and the head pointed on vertex of each lobe ...... *Rahinda hordonia ?*

d. Subdorsal fleshy processes on segments 3, 4, 6, 12, that on segment 4 prominent ; vertex of each head-lobe ending in a short point.

a^1. Segments 7 and 8 with a small subdorsal tubercle in addition.............................. *Neptis hampsoni.*

b^2. Segments 7 and 8 without the tubercle.

a^2. Sides of segments 9-13 with apple-green markings .... *Neptis jumbah.*

b^2. Sides of segments 9-13 without apple-green marks, simply ochreous.......... *Neptis eurynome.*

D. Larvæ cylindrical in shape, the form more or less hidden by the series of long, conical, fleshy, feathered supraspiracular processes directed horizontally outwards from segments 3-12 all round. The head fairly large, smooth : colour green. Pupæ triangularly pyramidal ; colour green marked with gold, silver or brown .... Gen. *Euthalia, Dophla*

a. Colour green with a straight dorsal yellow band only. Pupa green and gold................ *Euthalia garuda.*

b. Colour green with a dorsal row of about 9 vermillion spots. Pupa green, gold and black... *Euthalia nais.*

c. Colour green with a large dorsal white pentagonal mark on segments 5-12, often with a blue centre and soiled indian red. Pupa is green and gold with the eye brown .. .. *Euthalia lepidea.*

d. Colour green with a large plum-coloured dorsal patch on segments 5-12, obsolescent on some segments at times irregularly. Pupa green and silver................ ... ... *Dophla laudabilis.*

e. Colour green with a large brown-lilac dorsal mark on segments 3, 4, 6, 7, 9-12 with central white spot on front margin. Pupa is green and brown .... *Euthalia lubentina.*

E. Larvæ with bodies clothed with spines, simple or branched; heads smooth, tubercled or spiny, horned or not. Chrysalides slender in form compared to *Charaxes* and *Euthalia,* wings generally slightly dilated laterally. the head-points generally present; shoulders generally angulated and generally abdominal and thoracic tubercles developed more or less; there is generally a dorsal constriction. The colour of the larvæ and pupæ varies.

a. The head without long or distinct horns.

a^1. Head smooth without spines or tubercles the colour of body oily blackish or violaceous-brown.

a^2. Spines of body fine, ringed black and white. Pupa smooth, shiny with curved spiny processes on segments 2, 7, 9, 11, lateral; head with blunt points; colour bright green, crimson and gold.................... *Cupha placida.*

b^2. Spines of body all black or some white.

a^3. All the spines black. Pupa smooth for the section, with lateral angles on thorax, head quadrate; colour white, barred longitudinally black marked with orange .... *Telchinia violæ.*

b^3. Subspiracular row of spines only white or whitish. Pupa like that of *Cupha* but without curved processes .... Gen. *Atella.*

a^4. Head dark yellow-brown, a black spot at base of each cheek .... *Atella phalantha.*

b^4. Head yellow with two parallel bands across face .... *Atella alcippe.*

c^3. Spines on anal segment only white. Pupa like *Cupha* in shape but with many more curved spinous processes ; colour yellowish-white spotted minutely with black. The colour of larva is blackish .... *Cirrochroa thais.*

b^2. Head set with simple spines, tubercles or both, but without horns.

a^3. Vertex of each lobe of head with at most one conical tubercle larger than the rest ; no proper spines. The spines on body all more or less of one size. Pupa of ordinary shape, head and body with conical tubercles ; colour earthy brown and grey with yellow and gold.

a^4. Two dorsal branched spines on segment 12, one anterior, one posterior. Pupa always coloured brown or slatey .... Gen. *Junonia.*

a^5. Head deep blue, the apical tubercle of each lobe more developed than usual .... *Jun. lemonias.*

b^5. Head not blue but blackish.

a^6. Colour of body dirty yellowish with black speckling ; dorsum of segments 4, 5 grey-black...... *Jun. hierta.*

b^6. Colour of body black or blackish.

a^7. Neck orange.

a^8. Branched spines of body black *Jun. orithya.*

b^8. Branched spines of body soiled watery light orange ...... *Jun. almana.*

b^7. Neck black, not orange.

a . Body covered with little white tubercles, each bearing a pure white hair giving a shiny-frosted appearance ; spines black.................... *Jun. Atlites.*

b^8. Body covered with minute black hairs proceeding from minute white tubercles ; spines soiled transparent whitish .... *Jun. iphita.*

b^4. Only one dorsal branched spine on segment, 12 .... Gen. *Vanessa.*

a^5. Larva yellowish, black spotted with a strong subspiracular fringe of short hairs. Pupa with golden reflexions dorsally .... *Van. cardui.*

b^5. Larva and pupa not known............ *Van indica.*

c^4. No dorsal spine on segment 12. Pupa with golden dorsal points................ *Argynnis hyperbius.*

b^3. Circumference of head set round with stout simple spines, face set with flat tubercles. Sub-dorsal spines on segments 3 and 4 longer than all others. Pupæ with thoracic apex produced towards a foliaceous hammer-shaped process from abdomen dorsally; head-points generally expanded laterally ... Gen. *Athyma, Moduza, Pantoporia.*

a^4. Spines of body laterally compressed; colour of body not green. Pupa with dorsal processes small; plain brown.. *Moduza procris.*

b^4. Body-spines with cylindrical stems not compressed. Pupæ variegated with silver and gold markings................ Gen. *Athyma Pantoporia.*

a^5. Head-spines in one row round circumference; colour green. Pupa with the head-processes unexpanded; variegated with gold .... *Athyma perius.*

b^5. Head spines in two rows round circumference; colour green. Pupæ with the thoracic, dorsal and head-processes all strongly developed .... Gen. *Pantoporia.*

a^6. With a white dorsal mark on segments 8 and 9; pupa silvery and brown .... *Pant. ranga.*

b^6. With a purple-black dorsal mark on segments 8 and 9; pupa red-brown suffused dorsally gold ... *Pant. inara.*

c^6. With dorsal black saddle on segment 9 only. Pupa silvery-golden all over ....: *Pant. selenophora.*

c^3. Circumference of head as well as face set only with simple bristles; colour of larva oily purplish-black with dorsum yellowish, turning green before pupation. Pupa boat-shaped, smooth ...... *Parthenos virens.*

b^1. Head with two well developed horns.

a^2. These horns long and curved, stout; colour of larva white, marbled thinly black. Pupa with huge lateral foliaceous expansions, dark with bright spots: like a bat .... *Cynthis saloma.*

b^2. These horns long and straight, fine.

a^3. Larva banded black, red, yellow broadly. Pupa blotched black, grey, yellow, with foliaceous short expansions dorsally on abdomen .... *Cethosia mahratta.*

b^3. Larva not banded in colours. Pupæ of shades of green; wings slightly laterally expanded, curved; thorax and abdominal segment 6 dorsally pointed; headpoints present .... Gen. *Byblia, Ergolis.*

a^4. Larva green with dorsal whitish uninterrupted band .... *Byb. ilithyia.*

b^4. Larva green with white dorsal band interrupted on segments 7 and 11 .. *Erg. teprobana.*

c^4. Larva black with broad dorsal white band on segments 6-11 composed of parallel, short, white lines transverse to the length..................... *Erg. ariadne.*

c^2. These horns not short, branched and stout.

a^3. These horns metallic-blue as well as the body-spines. Pupa quite smooth, rounded, with conical head-points; very generally pinkish bone-coloured... *Doleschallia bisaltide.*

b^3. These horns not blue: they are black; the spines of body yellowish or red. The pupa is like that of *Junonia*, only much larger with the tubercles more developed; colour dark earthy-brown or pinkish-brown .... Gen. *Hypolimnus* and *Kallima.*

a^4. The spines of body claret-red. Pupa with pinkish shades .... *Kallima horsefieldii.*

b^4. The spines of body yellowish or dirty ochraceous. Pupa browns and greys. Gen. *Hypolimnas.*

a^5. Head brown-yellow with a black spot at base of each cheek .... *Hyp. bolina.*

b^5. Head orange with a broad black line on each side of clypeus reaching half way up face .... *Hyp. misippus.*

While all the danaine larvæ confine themselves for food to the two closely allied botanical families of the *Asclepediaceæ* and *Apocynaceæ* and the *Satyrinæ* to the *Gramineæ* only, the nymphaline caterpillars, numbering eight times the former and four times the latter, are distributed between quite twenty families. Most of the larvæ are confined to a single family and generally to a single species or, perhaps, two. A few are fairly cosmopolitan in taste as, for example, *Neptis jumbah* which feeds upon plants belonging to six different families. Nearly allied larvæ do not necessarily feed upon nearly allied plants. We find all five *Junonias* feed upon acanthaceous plants only, while the five *Euthalias* (including *Dophla*) have foodplants belonging to four different families, two feeding upon plants of one family and each of the others on plants of separate families.

In the above key *Cynthia* and *Parthenos* have been included although left out of the key of the Genera of the Sub-family. Neither of them will probably be met with north of Kanara. They can be recognised as follows, coming under B of the generic key :—

B. Costa of forewing not serrated, and

a. Cell of both wings closed for *Parthenos*.

a^1. Eyes naked, vein 12 of forewing not swollen and the colour green, while *Argynnis* and *Hypolimnas* are either black or tawny.

d. Cell of forewing closed, of hindwing open but in appearance closed by a fold in the membrane of the wing between veins 4 and 5 well beyond the origin of vein 3 for *Cynthia* ; the male is tawny, the female green.

There is a note of interrogation after *Neptis hordonia* in one case, because it has not been quite settled whether the two forms of larvæ belong to one butterfly or whether there are two species of butterfly closely resembling each other.

The acræine *Telchinia violæ* has been included in the key as the larva comes in conveniently.

DESCRIPTION OF SPECIES OF NYMPHALINÆ.

34. **Charaxes imna,** *Butler.*—Male *upperside* deep reddish fulvous. Forewing: a short bar on discocellulars and apical half jet black. Hindwing : a sinuous black line from costa to vein 7 ; a broad, posteriorly much narrowed, subterminal black patch from apex of wing to vein 2 ; two inwardly white-

margined black spots at tornus; the fulvous termen beyond black patch very narrow at apex, gradually widening posteriorly. *Underside* purplish brown suffused with a shining chalybeous tint in parts. Fore and hindwings crossed by a number of highly sinuous transverse fine dark purple lines more or less narrowly margined with white; the interspace between the outer two forming an irregular discal band bordered outwardly towards the tornal area in the forewing and along its whole length in the hindwing by a dark reddish-brown shade which is again exteriorly bordered on the hindwing by a broad dark purplish-black line with a row of minute white, then a row of black dots beyond it; terminal portion of both wings ochraceous-brown. Female *upperside*: ground-colour brighter tawny-orange; a broad, slightly oblique, white discal band transversely crossing forewing and continued on hindwing to vein 6, posteriorly suffused with pale fulvous with some of the dark marking of the underside showing through on the white ground as pale blue lunules; the broad black termen of the forewing and the black patch of hindwing much as in the male, but the former with a diffuse fulvous spot near tornus, the latter continued in detached spots to the tornal angle and traversed by a series of small white spots; terminal margin of hindwing dark reddish brown; the tail at apex of vein 4 spatulate instead of acute. *Underside* paler than in male but similar; the discal band pale yellow forming a sinuous band from apex of forewing to tornus of hindwing; the reddish-brown terminal margin traversed by an obscure ochraceous line on the hindwing bordered inwardly by a band of the same colour. Antennæ black; head, thorax, abdomen reddish-fulvous; paler beneath. Exp. 92-106 mm.

Larva.—The body is somewhat fusiform in shape, or pisciform, broader in the middle, squarely narrower behind, with a large, flat, six-sided head provided with four curved horns; the face is convex somewhat, with a depressed line down the centre; the two basal angles of the hexagon are rounded, from each of the others there springs one of the four horns, all in the same plane as the face, stout, slightly flattened anteriorly and posteriorly, round-topped and covered with little yellow tubercles, rigid and hard; the outside horns proceed upwards at an angle of 45° with central line of face, are straight till near tip and then curve in towards the central pair of horns slightly; these latter slightly diverge from each other at first, are straight, bent in at tips; the tops of outer horns are at same level as tops of inner ones, margin of head between horns has two longish, sharp, spine-like points between the inner pair, brownish-pink in colour like the horns, the others green, there being some between and below all horns; colour of the head is blue-green with a yellow marginal band flanked behind by a black line. Segment 2 narrower than head with a white mark or collar; anal end flat and square, the hinder corners produced each into a short, round-topped, conical point, giving appearance of a fish's tail although the space between the points is very nearly straight: the segment overhangs the claspers. Spiracles whitish oval surrounded by a black line, ordinary size. Surface of body covered with minute yellow and white tubercles, a row of four relatively largish ones along front margin of each segment. The colour is dark rich bluish-green, with a brown-yellow, narrow, subspiracular, beaded band ; in centre of segment 7 is a large semi-circular dorsal mark, white, suffused dirty, bordered by a broad line of deep Prussian-blue and with a central distinct cross of a dirtier shade : the mark nearly touches front margin and its apex is at a point $\frac{2}{3}$ of the width of segment from front margin, but is somewhat variable in size as also in extent of surrounding Prussian-blue line ; there are sometimes three or four or more lateral, large, circular white spots, bordered also blue, one to each segment : but these may be entirely wanting ; ventrum blue-white as well as pseudo-legs and true legs. L : 90 mm. ; B : 11 mm. ; L. of outer horn : 5 mm.

Pupa.—The pupa is short, stout, thickest in segments 7, 8, smooth. Head square in front forming a very slightly concavely curved edge, the ventral line being straight, the dorsal line of segment 2, head-vertex and segment 3 forming an uninterrupted curve starting at right angles to the ventral line, but immediately changing to become parallel to that line at posterior margin of segment 3, after which it ascends slightly to segment 7 which is the highest point of dorsum ; dorsal line of thorax has a tendency to carination; a section through the abdomen here would leave the posterior $\frac{1}{3}$ of the total length, consisting of segments 8-13, more or less hemispherical with the cremaster fixed slightly perpendicularly to the surface; somewhat on the ventral side of apex ; the cremaster is strong, rectangular, grooved above and below with a laterally buttressed base and a bunch of suspensory hairs at extremity ; on each side of buttress is a small red brown spherical tubercle and one more in front on ventral side : in all 6 spheres, 4 at base of cremaster and 2 in front of it, these last two nearly touching ; the lateral outline from head diverges in a straight line to the broadest part of pupa at segment 7, the wings, perhaps, being slightly expanded laterally ; no sign of a constriction ; spiracles of segment 2 longly oval, brown ; other spiracles elliptical, yellow-brown with a dark brown linear slit. Colour blue-green, subdorsal and lateral indistinct white line on abdomen, splotchy white markings on thorax ; underneath eyes, inside wing-margin suffused with white ; central white splotch on wing ; cremaster red-brown. Surface smooth, somewhat shiny. L : 28 mm ; B. : 15 mm.

Egg.—The shape is shperical, flattened slightly on top, even a little concave there. The surface is covered with little punctures except on top in the concave part where it is covered with little irregular, low-walled hexagonal cells ; the area between the concave top and the sides of sphere is crossed at equal intervals by 22 to 24 fine, beaded ridges which don't reach halfway towards centre of top nor any way down the sides of egg : the spaces between the ridges are indistinctly furrowed at right angles to ridges. The colour is bright yellow when just laid, soon becoming reddish brown with lighter spots. B : 2·5 mm ; H : 1·8 mm.

Habits —The egg is laid on the upperside of the leaf always, sometimes two or three. The little larva emerging lives on the upper surface, making a little bed of silk near the edge which it eats. It continues making beds of silk on which it lies all its life joining, when it gets too large for one leaf, two or three together to form the bed ; then it wanders to other leaves to feed and this nearly always in the evening, returning to its bed. It often rests with only the pseudo-legs of segments 7-10 on the leaf and on tip-toe so to say, sometimes even with only the two hinder of these legs or the middle two on the leaf, when its tail end and front part are held slanting up ; at times it rests with all legs and pseudo-legs on the surface. The larva does not change colour much before pupation and wanders long distances sometimes. The pupa is attached to the underside of a leaf, to a twig or stalk very firmly by a strong pad of silk. The egg-larva has the horns just as perfect as the adult but has longer tail-points which are tuberculate : and little sign of the large dorsal mark of segment 7 which, however, appears in the next stage clearly. The place chosen for laying the eggs is a very sunny situation in forest, generally somewhere in the neighbourhood of water if possible or, at any rate, very generally ; often high up on large trees, but as a rule within about ten feet of the ground, a spreading branch over a flat stone or open bit of soil being possibly the most favoured combination. The imago is certainly the strongest, finest and most active insect, with the single exception of *Eulepis schreiberi*, of these papers. Its flight is extremely rapid and powerful, consisting of a series of dives or jerks, the wings being brought together over the back between each dive ; it is often sustained for longish periods and nearly always high up in the air over the tree-tops in forest country with occasional descents into the open spaces. The males are fond of basking on the tops of high trees in the hot sun for hours at a time, sitting with the wings closed or very slightly opened, taking occasional short flights after another male of the same species, when both will sometimes mount high up into the air chasing each other in circles until they disappear in the distance for a time, or after another butterfly of another species, or for mere pleasure, to return again to the same leaf. They will come to the earth in hot steamy places in the beds of nallas on sunny days to imbibe the moisture on particular spots of sand or earth and will visit all sorts of refuse for the same purpose, especially such as smells strong and rotten. The females are rarely seen compared to the males; they keep to the thicker parts of the forests and do not bask or indulge in pleasure-flights, and imbibe nourishment from the saps of trees and fruits. Neither males nor females are ever seen at flowers. The insect is distributed in India from Lower Bengal to South India, and occurs nowhere else, though a very similar butterfly, *C. psaphon*, inhabits Ceylon. The larva has various food-plants; *Saccopetalum tomentosum*, *H.*, a large tree belonging to the *Anonaceæ* being one of the commonest: this is related to the Custard-apple: another is *Aglaia littoralis*, Talbot, a relation of the Neem's and *Tamarindus indica*, L., the Tamarind, though the last is not a favourite.

35. **Charaxes fabius,** *Fabr* (Pl. D, fig. 18).—Male and female *upperside* black; basal area of both wings brownish. Both wings crossed by a conspicuous sinuous discal series of sulphur-yellow spots, separate on fore, continuous on hindwing and a subterminal series of similar smaller spots, often incomplete towards apex of forewing. Discal spots increase in size posteriorly, that in interspace 1, being largest; on hindwing they are subequal, but those in interspaces 7 and 8 are paler, almost white. Forewing has also a sulphur-yellow spot, at lower apex of cell and a costal one obliquely beyond, traversed by veins 8 and 9. Hindwing with a terminal incomplete line of spots posteriorly ending in a larger blue spot at tornal angle. *Underside* lilacine-grey; basal area with two series of interrupted broken black lines; discocellulars black; discal spots and those beyond apex of cell on forewing as on upperside, but white, diffuse outwardly and inwardly margined by short black lines. This is followed by an irregular sinuous transverse row of ochraceous spots surrounded by black shading, crossing both wings; on the forewing the lower spots are margined, beyond the black, with diffuse white and, on the hindwing, the posterior spots are margined inside by white lunules. The hindwing bears, in addition, an inner subterminal series of white dots followed by an outer series of ochraceous spots lined inwardly black, then a few white spots and terminal black line. The tails of hindwing are well developed, longer somewhat in the female, slightly sharper in the male. Exp. 82-92mm.

Larva.—The body is subcylindrical, thickest at middle with the anal end square, flattened, with a small conical, round-topped tubercle or point at each posterior; angle, about equal in breadth to the neck; the head large, flat, more or less hexagonal with slightly convex face furrowed shallowly and broadly down centre, the surface rugose; on margin there are small simple spines and four horns lying in the same plane as the face, the two central horns pointing straight up on vertex, separated at base by a distance equal to breadth of face at eye-level and as long as breadth of head at middle; the outside ones, rising from a point $\frac{1}{3}$ of the length of face from vertex of head, grow out, up and slightly back, the curve being very slight, and reach only the level of head-vertex : they are equal in length to half the centre ones ; the outer margin of these side-horns bears three simple spines, the bottom one the longest, the margin of head beneath these horns has two or three small spines ; between the vertex-horns are two moderately large, sharp spines, one on each side of dorsal line ; the colour of head is green like the body, the jaws are rose-coloured, sides of head just above jaws with a rose coloured short stripe in front of which is a yellow stripe reaching to base of lower horn ; colour of central horns green covered with small tubercles bearing each a fine semi-adpressed seta ; the side-horns rose-coloured with tuberculous surface also ; the central horns are round-topped, the side ones bluntly pointed. The segment 2 is much narrower than head ; the anal segment is the narrowest part of the body. Surface of body covered with irregular rows of small yellow light tubercles, hemispherical in shape, each bearing a small white seta bent back at the tip, a golden-yellow subspiracular band composed of rather large hemispherical tubercles each bearing a small recurved seta : this band not extending to segment 2. Colour of body dark green with, sometimes, a large white circular mark dorsally on segment 7 which may occupy half the width of segment or less, or may be entirely wanting or be reduced to a small rose-coloured spot. L : 45mm. ; B : 7mm. ; L.of middle horns : 4mm. ; of outer horns : 2mm.

Pupa.—The shape is like that of *Ch. imna* only a little more elongated. Head square in front and convex transversely above, flat below, broader behind than in front. Wings slightly expanded parallel to each other from middle of thorax to segment 7 ; body is broadest at segment 8, the distance from end of wings to cremaster is only $\frac{1}{4}$ the total length and that part of the pupa is more or less hemispherical in shape, the cremaster being fixed well the ventral side of the apex of the sphere, or these abdominal segments are broad dorsally and narrow ventrally which is saying the same thing ; the cremaster is nearly perpendicular to the longitudinal axis of body and is moderately long, strong and square in transverse section ; at its base on each side are three spherical little tubercles as well as two somewhat flattened ones in front : 8 in all ; spiracles green, oval with a white central slit. There is hardly any constriction ; the thorax is long, convex to a small degree and with a tendency to dorsal carination. The surface is finely rugose under lens, somewhat shiny. The colour is grass-green ; a minutely marbled white lateral abdominal line ; another white line above spiracles ; front margin of head continued over shoulders along wings to segment 7 also white : cremaster and its tubercles reddish brown. L : 13mm ; B. 8mm. at thickest part.

Egg –Spherical, with longitudinal ridges fine ; colour translucent yellowish with a broad dark red irregularly margined zone round the upper half.

Habits.—The eggs are laid on the upperside of a leaf in the hot sun. The larva lives on the upperside of a leaf making a bed of silk to which it returns after feeding each time; in the first stage, immediately on emerging from the egg, the two anal points are comparatively very long, curved inwards and slightly upwards to resemble the fine thorns of its food-plant, *Wagatea spicata*, their length decreasing with each moult. The larva likes the sun and lies fully exposed to it. The pupa is formed under a leaf affixed to the under-surface or from a stalk, twig, &c. The butterfly is very active, strong on the wing and fond of basking on the tops of trees, choosing very generally a dead stick where it sits with its wings closed, a point of vantage from which to chase passing rivals; acting very much in the same manner as *Ch. imna*. It is a butterfly of the plains as much as of forests and hills and is found in the Himalayas from Chamba to Sikhim, in Oudh, Bhutan, Central Provinces, West and South India, Ceylon, Burma and Tenasserim. The food-plant of the larva is commonly Tamarind, the *Tamarindus Indica*, L., of the botanists belonging to the family *Leguminoseæ*; also *Wagatea spicata*, Dalz., of the same family.

36. **Eulepis athamas**, *Drury* (*vide* Pl. D., fig. 19.)—Male and female *upperside* black. Fore and hindwing with a discal broad transverse area from below vein 4 in forewing to vein 2 on hindwing, a moderately large spot in interspace 5, a minute preapical dot beyond in interspace 6 on forewing and a subterminal row of spots with a few spots beyond them on the tornal angle of hindwing: pale yellow, sometimes with an ochraceous, sometimes with a green tinge. The discal area of forewing nearly as broad in interspace 3 as on dorsal margin, on hindwing narrowing to a point on vein 2 at two-thirds its length from base. Longish tails touched with bluish grey. *Underside* with discal yellow area and spot in interspace 5 as on upperside; base and costal margin of forewing to apex and base and dorsal margin of the hindwing broadly lilacine-brown, with two small black spots in cell on forewing. Bordering the transverse discal area on the innerside, where it is margined with black lines, and above, is a broad curved chocolate band continued more narrowly along outer margin of discal area; beyond this on the forewing is a concave series of dusky black lunules: finally on the hindwing there is a subterminal series of internally white-bordered black spots followed by an obscure ochraceous terminal line and above the tornal angle a slender transverse black line from vein 1 to dorsal margin.—Exp. 64-85 mm.

Larva.—Body subcylindrical up to anal segment which is flatened on dorsum, square cut at end, the line being however somewhat concave, overlapping claspers, hardly pointed at corners; body fattest at middle, head large, segment 2 narrower than it. Head hexagonal seen from in front with slightly convex face and margin set with spines and four horns, the lower pair originating half way up side and more or less straight, reaching just beyond vortex of head and directed outwards at an angle of 45° with dorsal line of head; the middle pair also straight at first, curved inwards at tips, longer than head, is high, double the length of outside pair; both pairs of horns spiny along outside and inner edges, the spines on outside of lower pair continued on to cheeks to the number of three; between inner horns are two small points; all spines are small, simple and sharp; colour of head is green, striped paler longitudinally, jaws reddish, eyes black, head and horns covered with small, low, shiny, smooth tubercles, largest on horns. Body surface covered thickly with minute white tubercles. Spiracles of ordinary size. Colour of body a dark yellowish green, the belly light green; legs yellow; on segments 2 and 3 is a narrow yellow band along hinder margin continued on to base of leg by a broader white one; segments 4-11 with nearly always a diagonal whitish band from hinder margin dorsolaterally to front margin below spiracle and thence on to base of pseudo-leg of next segment preceding it: these bands do not meet on dorsum, but the ends are connected over back on each segment by a transverse row of small yellow tubercles near the hinder margin of segment; bands on segments 6, 8, 10 are considerably broader than those on other segments and are white bordered anteriorly with black: most of them are more or less suffused with green towards the dorsal region; some of them may be faint or wanting. L. 41 mm.: B. 6 mm.; L. of middle horns: about 4 mm.; of outer: over 2·5 mm.

Pupa.—Head square in front forming an edge that is slightly higher at the ends than in the middle. The pupal breadth increases from this edge up to segment 7, the ventral line being straight, and is bent in very slightly about the centre of wings; thorax, segment 2 and head have the dorsal line a curve, starting at right angles to the ventral line and becoming, at hinder margin of thorax, all but parallel with the longitudinal axis of pupa or its ventral line after which the dorsal outline continues, slightly ascending to top of segment 7, where the transverse section of pupa is a circle more or less and the remaining portion, segments 8-14, amounting altogether to little more than ¼ the total length of the pupa, forms a hemispherical piece with the cremaster fixed slightly ventrally of the apex; this cremaster is strong, rectangular and grooved above and below, is laterally buttressed at the base and has the bunch of suspensory hairs at its extremity; on each side of each buttress is a small yellow-brown, spherical tubercle and one more in front of each pair: in all six spheres, four at base of cremaster and two in front: these last two nearly touching. Spiracles prominent, oval and brown. The body is broadest at segment 7. The colour of the pupa is a yellow-green, slightly darker on the wings, striped, banded and dotted with white; a double subdorsal striped and dotted white band, the central lines nearer together on abdomen than on thorax and thinner: a lateral and supra-spiracular simillar band, the latter not produced on to thorax; inner margin of wings and underside of head also white and interrupted bands of white indicating the nervures on wings; cremaster brown. L: 20 mm.; B: 7 mm. at broadest part.

Habits.—The egg is laid in a sunny place on the upperside of a leaflet and the little larva, on emerging, immediately proceeds to make a bed of silk for itself on the upperside of the same or another leaflet to which it returns after feeding each time; when it grows too large for one bed it makes another, soon requiring three or four or more leaflets to rest upon; it often rests with its legs and the pseudo-legs on each side of the central pair as well as the claspers off the surface, the true legs bunched, head held with the horns thrown back and the pseudo-legs all contracted: it hits with its horns when teased and moves with a halting motion spreading abundance of silk. The type of colouring: green with diagonal parallel white or light coloured lines acts protectively, reproducing the effect of the *Acacia* leaf with its leaflets. The pupa is formed under a leaf or from a stalk or twig and hangs firmly, somewhat rigidly. The imago is somewhat variable in the breadth and shade of the discal band, in the darker or lighter shade of the general colouration and in size, due somewhat to season, also to locality. Consequently three or four species have been made out of the one by different authors. The insect extends throughout the Himalayas and in the hills of Central India; throughout the rest of India in suitable places; Assam, Burma, into the Malayan sub-region. It is plentiful round Bombay and in the Deccan in the wooded parts, for it is more of a forest insect than *Ch. fabius*; it has much the same flight as that insect but keeps nearer the ground, flying along the edges of glades in the jungles, along walks, paths, &c., where it may be found basking low down near the ground on a leaf of a shrub or small tree in the sun. The females are much more rarely met with than the males, because of different habits already referred to under *Ch. imna.* Neither sex visits flowers but sucks the sap of trees and fruits, are attracted by carrion and high-smelling substances, and the males may be found sitting in moist spots on roads and in the beds of nallas on hot sunny days imbibing water from the soil. The food-plants of the larva may be said to be all *Leguminoseæ*, though a caterpillar was once found on a species of *Grewia.* Known food-plants are *Poinciana regia*, Bojer, or Gold Mohur; *Acacia pennata*, Willd. and *A. cæsia*, Lam., both species of climbing *Acacia* with thorns; and the thornless tree *Albizzia lebbek*, Benth., known as Siras.

37. **Eulepis Schreiberi**, *Godart.*—Male : *upperside* black glossed indigo blue or light green at base of wings. Fore and hindwing with a broad white discal fascia from interspace 4 of forewing to just below apex of median vein in hindwing where it narrows to a point. On the outer side on both wings this fascia has an irregular border of smalt-blue which is narrowest anteriorily on both wings broadening out posteriorily. A white rectangular spot in interspace 5 of forewing and white speck above it. Hindwing: a subterminal row of small white dots, a terminal row of deep ochraceous spots and some smalt-blue markings on the tails and margins near the tornal angle. *Underside* pearly white, broadly brownish pink along the dorsal margin of the hindwing. Forewing: two black spots at base of cell ; a broad olive-green band edged on both sides with black, followed by a discal bluish-white band as on the upperside and beyond it by a transverse series of black lunules placed on a purplish ground ; a lunule in interspace 1 half obliterated by a large black spot ; apex and terminal margin broadly olive-green. Hindwing: a broad black edged transverse olive-green band in continuation of that on the forewing, terminating on vein 1, followed by a discal, broad, posteriorily narrowing white fascia as on upperside. Beyond this a postdiscal series of deep Indian-red lunules, placed on an olive-green ground and margined inwardly by a broad interrupted black line ; finally a subterminal narrow green band and terminal ochraceous lunules. Tails black, touched with smalt-blue ; above tornal angle a black line from vein 1 to dorsum. Antennæ, head, thorax and abdomen black ; thorax and abdomen on the sides and beneath whitish. Female differs very slightly from the male ; can be distinguished by the greater width of the discal fascia, also by the two spots above it being joined to it and larger ; by superior size and by the tails being somewhat broader and slightly less pointed. Exp. 92—116 mm.

Larva (*vide* Pl. I., fig. 4.)—The larva emerges from the egg about the 7th day after it has been laid. The horns of the head are soft, bent down and somewhat stunted looking but soon become erect and hard. The little caterpillar proceeds at once to make a meal of the egg-shell and then lies quiescent on the leaf for some hours before commencing to feed on the edge. It is at first of an olive green-brown colour with what seems, to the naked eye, a lateral row of minute white dots, one to each segment ; but which are really little light-coloured tubercles each surmounted by a minute hair : these are the dorso-lateral tubercles ; the subdorsal and supraspiracular ones are also there but are at this stage coloured like the larva. The head is large with four well-developed horns as in the adult but slightly longer comparatively and supplied with the same tynes as in the adult as well as the two points on head-vertex between the middle pair and another between each middle and lateral horn ; the colour of head is dark red-brown with the lower part of the face orange-brown. The tail points are as in the adult but they are longer and red-brown in colour ; the shape of the anal segment is the same also ; segment 13 is large and distinct ; segment 12 has a lateral large shiny swelling : the spiracle.

Soon the larva becomes green, minutely spotted with yellow after feeding on the green leaf for sometime ; the white tubercles become light green as well as the others ; there is no sign of the dorsal crescent mark dorsally on segment 7. The size of larva is 5 mm. growing to 10 mm. in seven days. After the first day it takes up a position in the centre of the leaf near the point on the upperside, covering the place with slight carpet of silk-web.

In the second stage the length and breadth are the same at the beginning: 10 mm. by 2 mm. ; the head is much bigger of course with the horns more spreading, the colour being light brown ; with the hinder border of anal segment dark red-brown ; the tail points are comparatively shorter and more divergent ; the anal segment yellow along its extreme hinder border (also at end of first stage), the points tipped dark. The colour of the body is green with four transverse rows of minute tubercles separated, each row from the next, by a thin, depressed line the tubercles as at end of last stage ; the characteristic dorsal mark on segment 7 appears but is very minute and hardly visible in some larvæ ; the tubercles and dorsal mark are whitish, the latter with a yellow tinge. The larva now sits with its front half raised from the surface it rests on, the true legs bunched. The size of the larva at end of this stage is 15mm. or 16mm. by 3mm.

The colour some time after the next change of skin is a fine dark green, the dorsal mark on segment 7 trapeze-shaped, broader than long, with a narrow, short, continuation forwards in centre ; light yellow in colour with the front margined black ; the head light brown-pink, bases of middle horns darker, anal segment shortly and broadly fish-tail shaped, the hinder margin, however, straight between the diverging points, the segment margined yellow at end with the points reddish-brown ; a fine yellow subspiracular line dividing the dark green of dorsum from the greyish ventrum from segment 5 to anal segment.

In the fourth stage the dorsal mark on segment 7 is as in the mature larva ; crescent-shaped, yellow, the ends of it pink set with little opalescent tubercles, bordered in front by a thick black line. Head green with a yellow border from base of lower horns round the jaws, the horns dark red-brown, covered with little yellow tubercles ; face smooth without tubercles ; the hinder margin of head dark red-brown. The anal segment is now flat dorsally, the points short, stout, blunt and divergent : trapeze-shaped, the longer margin being the hinder one. There is a yellow line from each tail-point to segment 5, subspiracular, dividing the rich dark-green of the upper parts from the delicate bluish-grey of the ventrum ; the tail-points are pinkish-brown at ends the hinder border of anal segment yellow : there is a narrow jet black collar on front margin of segment 2. The size at commencement of this stage was 22mm. by 4·5mm.

At the end of the final or 5th stage the larva has the same colour as in the last ; the dorsal mark on segment 7 also the same, yellow-greenish in colour, truncated at tips obliquely forward, the horns of the crescent touching the anterior margin of segment, the apex of the curve being [illegible] the breadth of segment from its hinder margin; the mark gradually becomes white towards the points which are suffused with pink and set with tubercles which are irrorated with red and blue like opals; the mark is bordered narrowly with black. The anal segment is still more like a fish's tail than in the last stage though the points are equally short and blunt and stout. Segment 2 is black-brown on front margin, then black, then green like the rest of the body: there is a white, raised, linear collar at front margin of segment 3 separated in dorsal line by a streak of body-colour and reaching ⅔ of the way down each side of the segment. The larva is like that of *Ch. imna* except that the horns are somewhat thicker, darker in colour, the cheek spines are stronger, the span of the horns greater. L: 70mm.; B: 10mm.

Pupa (*vide* Pl. I., Fig. 4*a*.)—The shape is identical with that of *Ch. imna*, the colour also, but the spiracles are brown-red and there is some similar colour on the underside of head. L: 21mm.; B: 12mm.; or larger in the same proportion, the females being the larger: some larvæ are very nearly 90mm. in length.

Habits.—One to four eggs of the type of those of *Ch. imna* are laid on the top of a leaflet, always singly and generally only one, in thick jungly places where the bush is either entirely open to the sun or under the checkered shade of high trees, and very often quite low down near the ground. The larva when fairly well grown makes a nest composed of a web-carpeted bed with a few leaves drawn over as a roof and generally in a thick bunch of leaves whence it sallies forth every evening to feed on the leaves of branches some distance from the resting place. After each moult the larva eats its cast skin in the usual way. Just before casting the skin, the new head appears as a light brown piece, in the place of segment 2, with 2 subdorsal brown pink stripes under the skin, quite smooth and without anything to indicate the position of the horns: the old head gradually gets pushed to the point of this piece in front, the stripes become by degrees pinker and pinker in colour, the larva begins to inflate the front part of the body slightly at longish intervals: then the pink stripes swell ever so slightly, especially the side ones, the new head-margin commences to appear as a brown band dorsally: then, suddenly, with a heave and a sudden jerk or two, the skin parts in the dorsal line and the whole new head bursts through the aperture quickly, the skin being pulled back by wave-like motions of the larval body from in front backwards. On first emergence the head is a light brown squarish piece with a deep furrow down centre with each lateral horn lying folded on to the face and bright rose-coloured, the middle ones lying along the margin of head between their own bases and the bases of the lateral horns: these horns are the pink stripes seen under the skin before emergence, the face being doubled back along its dorsal line; the head then is inflated by successive breaths of the larva and broadens out, one horn suddenly detaches itself from the head-surface, then another, gradually straightening out more and more with the breathing. growing somewhat in length though not in girth and assume their final shape, each little spine existing from the beginning and detaching itself from a surface it has been folded against as did the hole horn; the face flattens and broadens out; the old head is rubbed off the mouth, where it adheres after the skin has burst away from it by friction against the leaf-surface and the whole business is ended up by a thorough cleaning of the new mouth against the same surface. The cast skin, thin and white in a heap at the tail end on the leaf where it is attached by the claspers to some web, is then completely devoured. An egg laid on the 19th of October produced a larva on the 25th; this larva moulted the first time on the 2nd of November; the second time on the 14th; third on the 26th; fourth on the 11th of December; fifth on the 26th; changed to pupa on 25th January and the butterfly appeared on the 17th of February, which gives seven days in the egg; exactly three months as larva, but these were calendar months, amounting to 13 weeks; the pupal stage lasted 23 days. Three eggs obtained on the 28th July produced larvæ on the 4th August; these moulted on the 11th; one moulted for the second time on the 18th, two 15 hours later; again two moulted on the 25th and for the last time about a fortnight later. These larvæ took only two months to grow; the pupal stage lasted a fortnight. In the one case the butterfly emerged four months after the egg was laid; in the other the period was only two months and three-quarters. The monsoon insect was small and dark, the other large and lighter.

The pupa is attached much in the same way as that of *Ch. imna*; the imago has the same habits for male and female, but is even more seldom seen on or near the ground. The butterfly has been obtained in South India; along the Western Ghats; in Assam, Burma, Tenasserim and extends to Java. It is probable that it is even more widely distributed, but, from its habit of remaining high up and keeping to high jungle, it is difficult to catch and escapes notice.

The food-plant of the larva is *Wagatea spicata*, Dalz. or *Rourea santaloides*, E. & A., that belonging to *Leguminoseæ*, this to *Conneraceæ*, both extensive climbers, the former thorny with glabrous, shiny leaflets and long spikes of scarlet and yellow flowers, common throughout the Bombay Presidency in forest country.

The genus *Charaxes* is Palæarctic, African, Indian and Australian ; *Eulepis* is Indo-Malayan only ; there are about a dozen and a half species in British India, Ceylon and Burma. The two genera are very close to each other ; and in the earlier stages it would be difficult to separate them ; in the imagines, however, there is a slight difference of venation and extent of serration of the costal margin of forewing. The insects are the most powerful fliers of all butterflies as well as the most delicately marked, especially on the undersides where the combination of colours and clearness of pattern are exceptionally beautiful.

38. Apatura camiba, Moore. (Pl. C., figs. 15 and 15*a*).—Male, *upperside* deep velvety black, with three minute snow-white preapical spots on the forewing, one below the other ; the cilia of both wings alternately black and white. *Underside* dark purplish brown shaded at base of wings and along costal margin and apex of forewing with dark ferruginous ; both wings with two black spots in the cell, followed by an ear-shaped mark on the discocellulars and a median discal irregular band of dark brown markings outwardly interrupted, bordered with lilacine ; beyond the discal area both wings are shaded transversely with dark brown succeeded by a subterminal dark line bordered inwardly with purple ; forewing with the preapical white spots clearer ; hindwing with a small black subternal spot. Antennæ black ; head, thorax, abdomen velvety black, dark brown beneath.—Female *upperside* tawny brown. Fore and hindwing : basal half shaded and marked with brown followed by a transverse, irregular, brown median fascia and postdiscal brown shading like the underside of male ; the post-discal shading on the hindwing traversed by a series of dark spots ; on the forewing by a series of three to five sub-apical small white spots ; a transverse series of dark lunular markings on both wings as in the male underside just inside the subterminal dark line. *Underside* brownish yellow with the markings as in the male, but clearer. Antennæ, head, thorax, abdomen light brown, yellowish beneath. The wet-season form is darker in the underside of male and both sides of female than the dry-season form, and, as a rule, somewhat smaller in spread of wings. Exp. 46-52mm.

Egg.—Spherical in shape with eighteen meridional ridges which lose themselves on top ; interspaces between ridges finely striated at right angles to them. Colour dirty white with a brown spot on top and a circle of five or six more, $\frac{1}{3}$ of height towards base. B: 1mm.

Larva.—Shape fusiform, head small, square with two long, straight diverging, longly club-shaped rigid horns, one on vortex of each lobe in the same plane as face, separated at bases by a triangular indentation of vortex of head and set with two whorls of short spines, one at one-third of length from apex, the other at two-thirds; the anal end with two longish, diverging, conical, horny caudal processes, separated squarely at bases and simple, without spines. Head has the face slightly convex, marked on each side with a longitudinal black line. Spiracles oval, inconspicuous, situated on the green line. Surface of body smooth, without hairs. Colour is bright canary yellow with a lateral and spiracular sap-green band and a dorsal row of 11 large sap-green spots, one on each segment 3-13, sometimes one more, situated near the hinder margin of the segment; horns shiny black (rarely lighter), caudal points yellow, with internal side with a black line. L: 46mm. over all, of which the tail-points: 4mm; the horn: 6mm.

Pupa.—The pupa is lengthened and laterally compressed, keeled along dorsal line. Head with conical porrect point on each eye, separated by the straight frons; shape of head-piece trapezoidal; thorax short, dorsally highly carinated, convex; another carination from top of eye runs up to just before apex of this thoracic carina; wings are slightly expanded from the prominent shoulders to posterior margin of segment 5 in a sharp line; the abdomen is laterally much compressed and highly keeled in dorsal line: the carination starting from dorsal surface just after construction behind thorax runs up to form a large, triangular, laterally compressed tooth on segment 7, which is the highest part of pupa, whence the carina diminishes in height to anal end, each segment 8-10 and 11 having a small carinal tooth dorsally as well as segments 5 and 6; greatest breadth is at shoulders; the ventral line is straight from head to end of wings, or slightly curved, the part thence to cremaster is also straight but inclined to the other part at an obtuse angle. Cremaster triangular, extensor ridges very strong. Spiracles of segment 2 not distinct; rest oval, raised, light in colour with a striated small boss under those of segments 9 and 10. Surface of pupa smooth, somewhat shiny, striated finely diagonally on dorsum and transversely on ventrum. Colour green with the dorsal carina tipped brown; ventrum glaucous green. L: 21mm.; B: 7mm. at shoulders; H: 8mm. at apex of carina on segment 7.

Habits.—The egg is deposited on the underside of a leaf in a shady spot in jungles, preferably near water or damp ground and low down, up to 5 feet from ground. The larva lives on the underside of the leaf on a bed of silk, always fully stretched, generally its face bent down against the leaf-surface so as to bring the horns to point straight out in front and two or three small ones are sometimes found on one leaf. The pupa is formed, after wandering, on the underside of some leaf or stick and hangs rigidly parallel to the surface, for which reason the suspensory surface of cremaster is longer than broad. The butterfly is confined to jungle country and hilly regions and is plentiful in some places on the Western Ghats in Bombay and will probably be found at Mahableshwar and Matheran or in the Thana hills. The male basks in shady places, low down on bushes or higher up on trees, sitting with wings well opened, but is restless and does not remain long in one place and is quick of flight; the female does not bask but may be found fluttering about in thick places laying eggs; neither of them go to flowers. Colonel Bingham considers *A. camiba* to be a southern race of the northern and eastern *A. parisatis*; the former inhabits Southern India and Ceylon. The food plant is *Celtis tetrandra*, Roxb., of the family *Urticaceæ*.

Apatura is represented in both hemispheres.

39. **Euripus consimilis,** *Westw.*—Male *upperside*: forewing black with the following white streaks and spots: a long streak from base, outwardly broadened and diffused in interspace 1; a short slender streak in cell with a minute elongate spot below it; a broad, short, very oblique median band broadly interrupted in the middle; an oblique short row of slender paired streaks beyond in interspaces 3, 4, 5, followed by a more complete postdiscal series of similar streaks from costa to interspace 2; and a terminal row of small dots becoming obscure streaks towards apex. Hindwing white, traversed by the black veins with the termen anteriorly narrowly, posteriorly broadly black, the broad portion traversed by a subterminal series of four or five crimson spots and beyond by a terminal row of white spots. *Underside* similar; the markings broader, larger and more clearly defined, the hindwing with a small patch and two spots of crimson at base. Antennæ black; head, thorax, abdomen black above; head, thorax beneath, abdomen on sides and beneath marked with white. Female *upperside*: forewing similar, the white streaks much broader, single, not paired. Hindwing similar also but the black on the terminal margin not at all or very slightly widened posteriorly, entirely without the crimson spots: there is instead a marked dilatation of the black bordering veins 2, 3, 4. *Underside* similar to the upperside. Exp. 70-88 mm.

Egg.—The shape is that of a dome, somewhat higher than broad, narrower at absolute base than just above the same; with 21 or 22, generally the former, rather smooth, fine, transversely rounded ridges from base to near apex where they lose themselves in the surface, becoming thin at the same time; the interspaces between these ridges are six times as broad as a ridge on the greatest diameter of the egg and extremely finely rayed at right angles to the ridges. The colour when laid is green, becoming reddish at top the day before exclusion of larva, the red being the head of the caterpillar, then blackish all over B: 1mm.; H: only a little more.

Larva.—The larva is very like that of *Apatura iris* or the English Purple.

Emperor butterfly. The body is limaciform, thickest in middle, decreasing gradually to the narrow hinder end which terminates in two nearly parallel, conical processes about 2 mm. in length bearing short hairs ; also decreasing to segment 2 which is about the same breadth as body at segment 12 front margin and about the same breadth as head though somewhat lower. The head is nearly square but somewhat higher than broad ; the face almost flat each lobe surmounted by a stout cylindrical horn which is slightly longer than head is high ; the horn has a few short, yellow spines before middle and is bifurcated shortly at tip ; the horns are in the same plane as face and diverge at an angle of 35° being somewhat widely and squarely separated at bases ; on the hinder vertex of head between horns are two conical small red-brown spines ; along the side margin in continuation with outside face of horn are three sharp spines ; surface of head otherwise smooth and shiny ; colour of head dark green with a long, narrow triangular, white clypeus, a white band from base of each horn running down face along sides of clypeus to jaws, another white band separating face from cheek, spines on horns and vertex of head are tipped with black. Surface of body is dull and rough, each segment set with seven transverse rows of minute, conical, yellow tubercles. Spiracles flush, oval, rather large, light green with very narrow, shiny black border and a thin white central slit. Colour of body is dark green with a red spot in the spiracular region of segments 3, 7, 10 and on the common margin of segments 12 and 13, those on segments 7 and 10 larger than the other two ; the yellow tubercles each surmounted by a short hair ; a small brown dot or two next each spiracle. L : 42mm. over all ; L. of horn : 5mm. ; of caudal points 2mm. ; B of body at base of caudal points : 1·5mm. ; across head : 4mm.

In the first stage, after coming out of the egg, the larva has a very dark chocolate-coloured head and a green body set with minute white, prominent tubercles, each surmounted by a short, erect, light hair besides being spotted obscurely with white in rows, most evidently on the front segments of body. The head is round without horns of any sort, with a deep, fine, impressed central line to apex of the ordinary-sized, triangular clypeus where it splits, still impressed, to form the boundary of the latter ; the surface is convex, finely honey-combed rugose. The tail-points are rather long, stout, conical and diverging, with the flap between their bases. L : 6mm. ; B : 0·75mm.

In the second stage the head has become square with two cylindrical horns, as long as the head is high, one to each lobe-vertex, diverging strongly, inclined slightly forward over the face-plane, coarsely bifid at extremity, with some sharp tubercles on stems ; clypeus triangular, rather small ; surface of head rugose with two thick, blunt tubercles on hinder margin below horn-base ; surface shiny ; colour dark red-brown, except centre of clypeus which is green. Body surface slightly shiny, the tubercles numerous : the spots of last stage each surmounted by a hair : there are four transverse rows to each segment. Colour of body green with a large yellow dorsolateral patch on front margins of segments 6 and 8 and a smaller one, circular, on the other segments surrounding base of subdorsal tubercle ; a still smaller one surrounding bases of dorsolateral, supraspiracular and subspiracular tubercles which are all there ; the rows of tubercles are light in colour ; anal flap and belly whitish ; tail-points comparatively the same length which is that of a single body segment. Belly slightly hairy laterally. L : 11mm. ; B : 1·75mm. at end of stage.

The third stage is nearly the same as last except that there is an extra spine on head-margin below the horn : three below each other, the upper, longest and curved, besides a row of four pointed and short spines in a plane behind the horns ; surface of horns finely haired and rugose, shiny, with two spines on each side of each ; surface of head shiny, pitted finely ; colour of head light green with a dark brown stripe down face of each lobe, vertex dark brown as also base of horns ; horns and spines otherwise all yellow ; base of clypeus yellow in centre ; eyes dark brown ; labrum whitish ; jaws dark brown ; antennal joints both yellowish. Spiracles white, oval, flush, of ordinary size. L : 14mm. ; B : 3·5mm.

Pupa.—The pupa is also like that of *Apatura iris.* Looked at sideways the shape is that of a section of a circle, the straight ventral line subtending a quarter-circle curve formed by the highly convex dorsal line ; the abdominal segments are laterally much compressed and highly carinated in the dorsal line, the carina being thin. The breadth of pupa is the same from shoulders to segment 8 and s twice as high as broad in the middle ; segments 4-6 are separated slightly in the dorsal carinated edge and segment 6 is the highest part of the curve ; the transverse section in middle of pupa is pear-shaped. The head has two strong slightly diverging, conical points, narrowly separated at the bases and about 1·5mm. in length, about half as far apart at tips as the pupa is broad in the middle ; the width increases evenly in width from head to shoulders which have each two small tubercles ; the thorax or segment 3 is transversely convex ; the cremaster is stout, triangular, flattened above and below. The surface of the pupa is dull, transversely wrinkled all over under the lens ; there is a low, indistinct ridge from each head-point running on to the thorax and the lateral edge of pupa from shoulder to segment 4 is a ridge. The spiracles are depressed, oval, colour of the pupa. Colour of pupa green, densely streaked with white on the thorax and head, more obscurely elsewhere ; dorsal carinal edge and wing-ridge are yellowish ; a prominent brown yellow rugosity along spiracular line at hinder margin of segment 7. L : 29mm. over all ; B : 8mm. at middle ; H : 12mm. at segment 6.

Habits.—The egg is laid on the upperside of a leaf or near the edge on the underside. The larva eats the egg-shell immediately after emerging and then proceeds to make a bed of silk somewhere on the upperside where it lies. Having grown somewhat it betakes itself to the midrib, lying along it near the point, covering the surface of leaf there with a thick carpet of silk; over this carpet it weaves a network of silk free from the bed beneath, a sort of hammock across the somewhat doubled leaf and rests thereon with its face turned down in the same plane as ventrum, so that the horns are directed out in front and rest on the subtending web-surface also. When about to pupate the larva wanders, finishing up on the under surface of some leaf, where it undergoes the transformation. The pupa is stoutly and rigidly attached by the tail so that the ventral surface is nearly parallel to the leaf. The imago is a jungle butterfly confined to the hills but is found on the sea-coast in the South Konkan wherever the foodplant exists: at least the female is, though rarely; the males bask on the tops of high trees on the hill-tops with the wings slightly opened and have a fluttering flight like the day-flying *Zygœnidœ*. The females fly like danaines which they resemble very much. *Euripus* is an uncommon insect but may occur anywhere along the Western Ghats for the foodplant of its larva comes up in freshly cut forest clearing wherever the rainfall is not deficient. This foodplant is *Trema orientalis*, Blume, of the family *Urticaceœ*, an extremely rapidly growing plant, reaching the state of a small tree, the wood extremely soft, useless, the leaf like the leaf of a nettle, the young shoots rosy red, the foliage somewhat scant. The insect occurs in the Himalayas from Sikhim to Kumaon; in Southern India; Assam, Burma, Tenasserim.

Euripis consists of 2 species extending from Sikhim eastward through Assam, Burma, and Tenasserim to China and southward to the Malay Peninsula and Sumatra.

40. **Dophla laudabilis,** *Swinh.*—Male *upperside* dark metallic green, sometimes with a yellowish tint in the cold weather or in old specimens; cell with two median sinuous, short black lines across it with a crimson spot between them; two similar lines beyond on each side of discocellulars, followed by a dark irregular transverse shading between the veins; beyond this the costa is broadly greyish white with a silvery lustre up to just before apex of the wing, spreading down diffusely but not extending below vein 6; apex and termen obscurely dark. Hindwing: a slender black loop in cell and a very obscure discal and subterminal macular dark band. *Underside* sap-green, suffused thickly with plumbeous-grey. Forewing: the transverse black slender lines and crimson spot as on the upper side; a very obscure subterminal series of dark spots parallel to terminal margin. Hindwing: three crimson spots encircled by slender black loops near base and a very obscure subterminal series of dark spots in continuation of that on the forewing, but obsolescent posteriorly. Antennæ brown; head with a crimson streak behind the eyes; thorax and

abdomen greenish brown, greyish beneath. Female similar, with similar markings above and below, the ground-colour on upperside paler, the greyish-white patch on the upperside very wide at the costa, extending as a broad transverse band with outer diffuse and inner sinuous margin right across the wing to vein 1; on the hindwing it is much narrower. Exp. 93-112mm.

Larva.—Body limaciform, segments well marked, anal segment in a plane at right angles to longitudinal axis; segments 2 and 3 being shorter than the others, the former being the smaller and being much lower and narrower than the somewhat large head. This head is equilaterally pear-shaped, face convex, surface glabrous and shiny; it is also thick. There are ten supraspiracular, long, conical, fleshy processes, one to each of the segments 3-12 on each side extending out all round the body and lying flat on the surrounding leaf-surface: all are longer than the body is broad, those of segments 3 and 12 are directed out in front and backwards respectively in a line with the body, those of segments 4 and 11 diagonally forwards and backwards respectively, the rest at right angles to logitudinal axis of larva out side-ways; segments 1 and 2 are therefore covered by the processes of segment 3, while those of segment 12 cover the two anal segments; for all these processes are clothed throughout their length with numerous fine spines, few spines, towards their extremities, being longest and slightly recurved at tips: the majority of the spines are in the horizontal plane of the processes but some short ones stick vertically up; all these spines are parallel more or less and longest towards centre of each process, those of adjacent processes being interlaced for the basal halves of their lengths so that the ventral margin of larva is only dimly visible. Two transverse rows over dorsa of segments 4-12 of short, sharp, green tubercles behind the purple mark. Head green; body also green; the spined or featherd processes are light plum-coloured for the basal third of their length, followed by a white bit, then more than half green with the extremities white; the dorsal anterior halves of segments 6-12 is plum-coloured (reddish brown-blue), the colour between the bases of the processes and on the whole of segments 3 and 4 being fainter than elsewhere; on segment 5 there is hardly any of this colour at all; on the plum-colour of segments 8—12 there is a dorsal central white annular mark, more prominent on segments 8 and 11; segments 4, 6, 7 have a white spot instead of the annulus, also segment 13; segment 5 has also a small white ring on front margin. The extent of purple marking, also the white, is variable and may be wanting on some segments; The larva is white in colour on emerging from the egg. L: 70 mm. over all; 50mm. without processes; B.: 50mm. with processes; 10mm. without.

Pupa.—The pupa is an irregular 4-sided pyramid in shape standing on a base formed by the plane passing through the spiracular lines on each side. The abdomen at centre of segment 7 runs up into a point, the segment being broad; from this point one side of the pyramid runs down centre of the segment on each side to base at spiracles, one side down dorsal line of pupa towards thorax, the longest, one backwards to cremaster, short, very steep and rather imaginary, the dorsal line there being without ridge or carination. The head seen from above has a deep semicircular sinus on front margin, leaving a well developed conical point porrect from each eye, the margin in the dorso-ventral direction thick and rounded as also the sides of the head, the underside slightly convex; the thorax (segment 3) is twice as long as segments 2 and 1 together, flat on side-slope from rounded dorsal region; lateral outline of pupa continued in a straight line with segment 2, the two sides diverging regularly to segment 7, *i.e.*, the pupa increases regularly in width up to middle of that segment which is 2-3 the total length from front of head; the width then decreases rapidly to cremaster: that part of pupa being more or less hemispherical on a base formed by a transverse plane through pupa at centre of segment 7; the dorsal line runs from head, with very little constriction (of pupa) at segment 5, up to culminate in the apex of pyramid in centre of segment 7, the sides of dorsum of segments 5 to centre of 7 being flat, sloping evenly from edge of pupa, including a slight expansion of the wings, to the dorsal line; cremaster fixed slightly on ventral side of apex of hemisphere formed by anal 1-3 of pupa, stout, oblong, somewhat curved, with a circle of six hemispherical small tubercles at base. The ventral line is slightly convex about middle, the wings being somewhat thickened at ends. Spiracles oval, conspicuous, yellow with black central slits. The surface is smooth and shiny. The colour is green, marked with a large spot at each corner of segment 2 behind antennæ, a larger one at apex of thorax touching segment 4, one still larger at each shoulder, a broad band along centre of segment 7 including the angular sides of the pyramid, wavy in outline not bordered with black, anteriorly (the spiracle appears as a black spot in this band): all silver bordered with black. L.: 25 mm.; B: 15 mm. at segment 7 where the H: 1·35 mm.

Habits.—The egg is laid on the upperside of a leaf in a shady place in a nalla in the damp jungles of the Western Ghats from sea level up to some 2,000 feet, very generally within a few feet of the ground though sometimes 15 feet up. The little white egg-larva settles itself down on the midrib when it emerges, making its first meal as usual of the egg-shell, clothes its seat with silk and feeds on the edge of the tough leaf: for the leaf chosen for the egg is never a young one and the larva prefers them of a certain age. The caterpillar eats in the evenings generally and, when bigger, goes away to some distance from its bed to feed. When about to cast a skin it will stand for hours with the front six segments raised in the air at right angels to the rest of body. The flight of the imago is powerful and rapid, consisting of downward strokes of the wings from well above the horizontal to somewhat below it, in which latter position the insect keeps them longest, sailing along thus. The males do not bask on the tops of trees though they are found so doing down in the shade near the ground or even on the ground with their wings generally opened wide, and the females do likewise though they are not nearly so often seen; they both visit fruits and saps when thirsty but not flowers. *D. laudabilis* is confined to South India but is very like *D. evelina*, Stoll from Ceylon. Its foodplants are *D. Candolleana*, Wight, *Diospyros melanoxylon*, Roxb., both Ebonies; or even *Anacardium occidantale*, L., the Cashew-nut tree. The pupa is formed on the underside of a leaf of the tree or in the neighbourhood. The genus *Dophla* is Indo-Malayan.

41. **Euthalia lepidea,** *Butler* (text-fig. 14).—Male and female *upperside* dark brown, paler in the female, with very obscure black markings of transverse lines across cell of both wings and an oblique discal fascia on the forewing; an ash-grey continous band along the termen of both wings, gradually broadening from apex of forewing where it is very narrow to tornus of hindwing where it covers one-third of the wing; cilia white; in the female there is a narrow brown terminal border. *Underside*: male ochraceous brown, female bright ochraceous; the colours paler on the hindwing; the forewing somewhat narrowly, the hindwing much more broadly suffused with lilacine-grey on the terminal margins and along dorsal margin of hindwing; cells of both wings with dark brown, sinuous, transverse lines and loop-like markings; both wings crossed by somewhat diffuse broad discal and narrower postdiscal dark bands, prominent on forewing, obscure on hindwing. Male with a patch of specialised scales above vein 4 on upperside of hindwing. Exp. 70-80mm.

Larva.—The shape is the same as that of *Dophla* just described, with long feathered processes all round from segments 3-12 except that the feathers or spines are finer and somewhat irregular in length, all tipped with light yellow; some spines stick straight up and are completely light yellow in colour; the body is bluish green with a row of four small tubercles near hinder margin of segments 3 to 11 and parallel to it as also a row of 2-4 about centre of same segments; some small white spots irregularly disposed on the same segments; ventrum and sides glaucous blue-green; on segments 5-10 there is a lateral white blotch just behind base of processes from the anterior side of which rises a comparatively longish, white, pointed tubercle; segment 3 has a small white cross in centre of dorsum and segment 4 has a white dorsal line; there is a large white mark, more or less suffused with soiled red-brown on segments 5-12, pentagonal in shape on segment 5, hexagonal on the other segments, half the breadth of segments and nearly as broad as long; all the marks have a central blue spot; a reddish-blue stain on sides of anal segment. L: 40mm.; 60mm. including processes; B: 7mm.; 32mm. with processes.

Pupa.—The shape is the same as that of *Dophla* except that the head points and lateral and apical points of pyramid are slightly less pointed, the former perhaps shorter comparatively. Spiracles oval, small, light yellow. Colour green, band in centre of segment 7 over apex of pyramid gold, shiny, interrupted broadly laterally and narrowly further on by the wing-line, enclosing a spot of ground-colour dorsally; a large spot dorsally on hinder margin of thorax, a smaller one behind each eye on thorax, a still smaller one on front of strip of hindwing apparent dorsally: all gold; eye brown. L: 18mm; B: 12mm. at segment 7.

Habits.—The habits are much the same as for *Dophla* also; the larva lies in the middle of the leaf not far off the ground in shady places in damp jungles in the hills. Pupa attached in the same way to the underside of a leaf, but the larva wanders less. The butterfly has the same flight but is weaker on the wing: basks in the same way close to the ground, or on the ground; the female is nearly as plentiful as the male, they are both fond of saps of trees and fruits and shun the full glare of the sun. The insect is found in the Himalayas from Almora eastward: from Assam to the Malay Peninsula, Orissa, Bengal, Central Provinces, Nilgiris, Kanara in Bombay, Mysore and Travancore.

The food-plants of the larva, as fixed up to the present, are *Careya arborea*, Roxb., one of the myrtle family, growing to a medium-sized tree, with large obovate leaves, nearly a foot in length, in bunches at the ends of the branches and a round fruit, the size of a small apple, and of a green colour; distributed throughout the Himalayas to Assam and Burma eastwards; in Bengal, Central, Western and Southern India; and *Melastoma malabathricum*, L., the Indian Rhododendron, a small shrub with a red flower, from which it gets its English name and rough strongly-nerved ovate pointed leaves found nearly throughout India in damp regions up to 6,000 ft. altitude; plentiful in the Konkan along nallas and in the vicinity of evergreen forests.

42. **Euthalia lubentina,** *Cramer.*—Male: *upper side* dark-green, sometimes with a brownish shade. Forewing: a bar across middle, another beyond apex of cell crimson bordered with black; a slightly oblique transverse discal series of small white spots from costa to interspace 1, followed by a preapical curved row of four similar ones and a transverse subterminal series of elongate black spots forming an obscure band. Hindwing: a crescent-shaped black loop near end of cell; a curved post-discal series of four or five crimson spots outwardly bordered black, the sub-costal the largest, followed by a subterminal series of velvety-black subquadrate spots, the anterior three and the tornal one outwardly crimson. *Underside* dark purplish-brown, suffused slightly with

ochraceous, the markings as above but larger, more clear and in addition on forewing: two small black spots at base; basal half of costal margin crimson; hindwing, four crimson, black-bordered spots at base: costal and dorsal margins crimson; another spot in the postdiscal series; the velvety-black spotting of upperside obscure. Antennæ dark-brown; club crimson below; head, thorax, abdomen dark-greenish brown; beneath palpi and forelegs crimson, rest pale brown. Female similar, paler. *Upperside* forewing: the cell bands obscure with a broad black-bordered white band between the discal white spots very large, irregular in shape. Hindwing: ground-colour suffused with greenish blue on terminal posterior half; markings like in male. *Underside* brown, tornal half of hindwing bluish green. Forewing: marked as above with extra two small black spots at base and an obscure broad terminal pale band. Hindwing: as in male. Antennæ, &c., as in male but paler: palps beneath striped pink, the forelegs whitish. Exp. 68-84 mm. Female always larger than male.

Larva.—The shape is the same as that of *Dophla* exactly; the head is heart-shaped, narrow side uppermost with a depressed line down centre over vortex; finely haired about jaws, green in colour and dark-brown eyes and jaws. Spiracles oval, large, light brown. Surface of body covered with transverse rows of light yellow, shiny, small knobbed tubercles, each with a fine, soft hair growing out laterally from top; these tubercles very sparse on the lilac dorsal patches and wanting on the larval surface below the processes. Colour of larva above the processes is yellowish green; segments 3, 4, 6, 7, 10-12 have a large brown lilac dorsal patch bordered by front margin extending from process on one side to process on the other and stretching back ⅓ the breadth of segment, becoming slightly broader (down sides) behind; each patch has a dorsal, white, small spot on front margin of segment; segments 5 and 8 have the patch green, and it is only noticeable because of the lack of yellow tubercles; processes dark-green, glaucous looking with the extreme quarter purple; body under processes and ventrum white. L. 55mm. over all: of body alone, 38mm.; of processes: 11mm.; B. 7mm. with processes, 24mm.

Pupa.—Pupa is the same as *Dophla* in shape; thorax slightly convex; abdominal pyramid proportionately high, the distance from head to apex being longer than in that insect in proportion, the distance from cremaster smaller. Spiracles prominent, oval, green with central black slights. Colour shiny green; a large shaded brown spot at base of forewing dorsally; a smaller one at base of hindwing where it appears underneath the forewing; one before the former on margin of pupa, another on hinder margin of thorax dorsally or not: all brown. L.: 19·5mm.; from front of head to apex of pyramid: 9·5mm.; H. at apex segment: 7·12mm; B. at segment: 13·4mm.

Habits.—The habits of larva are much the same as those of *Dhopla* but *lubentina* chooses very sunny hot places to lay its eggs, although the larva generally gets into the thick shades of the leaves of the plant it is on ; it lies in the middle of the leaf and pupates as a rule on the underside of the last leaf it has been on when still feeding ; the pupa is attached rigidly at an angle of about 45° to leaf surface. The flight is the same as described for the other imagines of the genus, the males bask with wide-opened wings on the tops of the trees and generally towards afternoon, the females are only seen in the underwood ; both distain flowers but visit fruits and trunks and stems of trees for sap. The insect is found in the plains sporadically near the hills and is distributed in the low hills of the Himalaya from Hardwar to Sikhim ; eastward through Assam and Burma to Sumatra ; and in peninsular India southward from Bombay. The food-plants of the larva are mistletoes of different sorts ; *Loranthus scurrula*, L. and *Loranthus longiflorus*, Desrouss, being two upon which the larva has been found ; these mistletoes grow in the same way as our home one, that is are parasitic on trees of different sorts attaching themselves to the branches where they form conspicuous clumps of leaves.

43. **Euthalia garuda** *Moore* (Pl. C. fig. 17♂, 17a♀).—Male : *upperside* olivaceous green-brown or olivaceous green. Forewing : two transverse black, lines at base of cell, a black loop across middle and another at end, with their centres dark-brown, followed by an angulated discal dark-brown band bordered outwardly by a series of five white spots ; two pre-apical white spots beyond and a broad, somewhat diffuse subterminal black band broadening over the apex angulated inwards in interspace 1. Hindwing shaded with dark brown at base. two crescent-shaped dark brown loop-like marks in cell ; a discal series of dark-brown elongate, outwardly acute, inwardly diffuse, somewhat hastate spots followed by a subterminal series of small spots of the same colour. *Underside* ochraceous brown. Forewing : five transverse slender black lines across the cell, a black spot below median nervure ; discal and pre-apical white spots as above succeeded by a postdiscal series of somewhat diffuse crescent-shaped black marks and a broad terminal pale lilac band not reaching the apex, bordered narrowly along termen with dark brown. Hindwing with four or five slender black loops at base, a posteriorly obsolescent post-discal series of diffuse black marks and a subterminal series of black dots ; termen near apex touched with pale lilac. Antennæ, head, thorax, abdomen dark brown, the antennæ ochraceous at apex, the body paler beneath.—Female similar but paler. *Upperside* no dark discal and subterminal bands, the series of discal spots elongate, much larger. Hindwing : the discal series of outwardly acute black markings nearly obsolescent. *Underside* similar to male but ground-colour more ochraceous, the markings larger, more diffuse. Exp. 68-79 mm.

Larva (Pl.I, Fig. 6).—The larva is the same as the other species in shape, the type of that of *Dophla laudabilis*, Swinh than which, however, it is much smaller, also differing in colour. Spiracles oval, largish, white. Colour of larva is dark-green all over, processes and their spines included ; tips of processes, inner edge of spines and a broad dorsal line from head to tail light yellow : the dorsal line covered on segments 2 and 13 by the feathered processes, but continued beyond by the light yellow edges of spines and tips of processes to the midrib of leaf which is also yellow ; the dorsal yellow band touched on each segment with blue-red which colour is suffused on to the green somewhat on each side. L : 55 mm. over all ; 34mm. without processes ; B: 32mm. over all ; 6mm without processes.

Pupa (Pl. I, Fig 6a).—The shape is exactly that of *Dophla* ; head points slightly less developed perhaps, constriction also slightly-less dorsally, pyramid less accentuated. The spiracles of segment 2 are white, flat and face somewhat forward ; the other spiracles are oval, dark-brown, of ordinary size. The surface is shiny and smooth. The colour is green, light ventrally ; ridge of segment 7 broadly gold with a black spot anteriorily on apex of pyramid : the gold interrupted thinly by line of wings laterally, the extremities bordered with black ; a black spot on dorsal line of segments 5 & 6 near hinder margin : a large circular gold spot dorsally at hinder margin of thorax, bordered broadly black ; edge of pupa yellow on wings with a black spot on shoulders ; a lateral raised gold spot on front margin of thorax bordered laterally black ; head-points yellow on the inside with an "S" shaped dorsal black mark. L: 22 mm. ; B: 13 mm. at segment 7.

Habits.—The habits are the same as for the rest of the *Euthaliæ* in the manner of oviposition and ways of larva and pupa. The imago has the same flight also, the male basking occasionally on the tops of trees, oftener lower down ; the female more rarely seen and then chiefly when busy laying eggs ; they are both fond of the sun and are insects of the plains and open spaces as well as of the hills and forests ; in fact they are found all over India except in the higher ranges of the Himalayas, being met with even in Sind ; extending to Assam, Burma, Tenasserim to Sumatra. In Bombay the insect is everywhere one of the commoner species, being plentiful wherever there are mango trees or cashew-nut trees. The female of this species, when engaged in laying eggs may be seen, if carefully watched, or heard hammering the leaf-surfaces with the imperfect front legs before depositing an egg ; *E. lepidea* has also been seen to do this. The reason may be to frighten micro-ichneumons or spiders off the leaf in case they should be there, for the newly laid egg must be very easy for the former to pierce and lay its eggs in while the latter would most surely devour the little caterpillar immediately it made its appearance. The food-plants of the larva are *Mangifera indica*, L., the mango and *Anacardiam occidentale*, L., the cashew-nut tree. The dorsal yellow band of the larva lying on the midrib of a leaf so exactly corresponds with that midrib, the filminess of the feathered processes and colour of the whole so resembles the leaf-surface that the caterpillars are very difficult to spot.

44. **Euthalia nais**, *Forster* (Pl. C., fig. 16).—Male and female : *upperside* tawny yellow; base of both wings dusted with fuscous scales ; cilia black, alternated with white. Forewing with the following black markings : a transverse line below apex of cell, an oval transverse spot beyond encircling a small yellow spot, a broad, short, oblique discal bar and an angulated postdiscal lunular band ; the costa narrowly and the termen shaded with black. Hindwing : a comparatively large triangular patch below the middle of the costa, a postdiscal evenly curved series of spots and a broad band along the termen black. *Underside* dark ochraceous red. Forewing : base shaded with fuscous black, two spots at the base of cell and a transverse line beyond crimson-pink, edged with black ; a very broad oblique discal band angulated downwards below vein 4, bordered posteriorly by a large black spot on the inner side and outwardly and anteriorly by an oblique broad black band followed by four anterior obliquely-placed ochraceous-white spots and beyond by a very narrow lunular black band bent downwards below vein 6. Hindwing : a crimson short line at extreme base, two crimson black-bordered spots in cell ; a comparatively broad and transverse discal white band often broken up into a large spot below middle of costa, with two or three spots in line below it ; finally a post discal series of small black spots. Antennæ black, bright ochraceous at apex ; head, thorax, abdomen tawny-red above, brown, shaded with crimson-pink below. Exp. 58—70mm.

Egg.—Is hemispherically dome-shaped ; green in colour ; shiny, with the tops of the cell-walls brown. There are 7 hexagonal cells immediately round the apex where there is a punctulate space as large as the largest cell ; there are 7 rows of cells from top to base but these rows are not regularly horizontal, the two last rows at base are small cells and have no brown tops to walls ; all cells are concave and smooth : there is a colourless, thickened hair-like process surmounted by a brown pointed hair at each intersection of cell-walls : the process including hair not being quite as long as breadth of largest cell. B. 1·5mm.; H. a little less.

Larva.—In shape and style the larva is the same as those of *Dophla* and other *Euthaliæ*. It has the same long, horizontal, feathered processes to segments 3-12, all lying with the points on the leaf surface when the larva is at rest. Head piriform, face convex with a small triangular clypeus ; covered all over with short, soft white hair, colour green, clypeus bluish, jaws colourless with dark tips, eyes black. Head larger than segment 2. Anal segment triangular, sloping and thickened ; body surface dull and transversely line with a row of minute white tubercular spots between every two lines. Colour green with a circular, dorsal, large spot on each segment 4-12 which is deep violet becoming light towards the red-tinged yellow centre, bordered black : the yellow centre developing only when the larva is full-grown and the black border is narrowly flanked on each side with white; sometimes these spots are red. The belly is bluish-white ; processes are green, light brownish at extremities, the terminal spines black with white tips. The side processes are set with spines all round, each spine ending in a short hair. Dorsal mark of segment 4 is small and transversely oval near front margin, that of segment 12 slightly larger, longitudinally oval, but still small compared to the others. L : 32mm. without processes, 45mm. with ; B: 6mm. without, 23mm. with processes.

Pupa.—The pupa is of the same shape as that of *Dophla* ; the dorsal pyramid of segment 7 well developed as also the two head-points ; cremaster very strong with three lateral tubercular small knobs, the hinder ones close together ; ventrally there is a row of 6 smaller knobs along each ridge ; the end of cremaster is set with a dense brush of short, black, hooked hairs : it is truncated triangular in shape, thick. Surface of pupa shiny, smooth segmental divisions not easily visible. Spiracles of segment 2 plain, oval, slightly convex, rather large, whitish ; the others also fairly large, oval, slightly convex with the central slit plainly visible, light-green in colour. Colour of pupa green, top of ridge of segment 7 broadly gold with the apex and each extremity touched with black, its front edge borders thinly black ; a black spot on each shoulder, each head-point tip and dorsally on hinder margin of thorax ; a golden semi-circle tipped with black behind touching each spiracle of segment 3. L : 21mm. ; B : 11mm. at segment 7 ; at shoulders, 8mm. ; at head-points, at tips, · 4mm.; H: 10·5mm. at segment 7.

Habits.—The egg is laid singly on the underside or upperside of a leaf ; the young larva is whitish. Larva lives on the midrib near base of upperside of leaf on a bed of silk ; walks haltingly, is sluggish in its movements, eats from side of leaf, preferring old leaves to young ones and hardly ever finishes eating a whole leaf wandering about a good deal. The pupa is attached, as usual, to the underside of the leaf firmly. The imagines have the flight already described for others of the genus and are fond of sitting on paths and other open spaces in the sun and do not often light on leaves ; they are most active in the heat of the day and both are equally plentiful where they occur : they do not take long flights. They are insects of the plains and do not occur near the sea-shore or much below 1000′ above sea level : they are found also in forest country where the land is flat and fairly dry and not too heavily wooded. The distribution is throughout the plains of India ; in the lower Himalayas, Southern India and Ceylon. The foodplant of the larva is *Diospyros melanoxylon*, Roxb., belonging to the family of the *Ebenaceæ* or Ebonies, a tree that grows in the Deccan and Ceylon in places of very moderate rainfall. It is more than probable that the larva also eats other species of Ebony.

The genus Euthalia is Indo-Malayan extending to China.

NOTE.—With this paper is published Plate D.

Plates A, B, C were published in Vol. XVI, facing page 576 and in Vol. XVII facing pages 418 and 921 respectively of this Journal.]

(*To be continued.*)

PLANTS OF THE PUNJAB.

A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB NORTH-WEST FRONTIER PROVINCE AND KASHMIR.

BY

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Indian Medical Service.

Part IV.

(Continued from page 398 of this Volume.)

Shrubs with Alternate Stipulate Simple Leaves.

Petals Ununited.

Capparis spinosa, **The Caper,** *Kakri, kander.* CAPPARIDACEÆ. F. B. I. i. 173. The Plains to 5,000 ft. Sutlej Valley (Collett). Choa Saidan Shah, (Donie).	small, trailing, young parts with yellowish white wool ; leaves 1-2 ins. long, broadly ovate, thick, abruptly terminating in a sharp point, stipules of two spines, straight or curved ; flowers solitary, 1-3 ins. diam., white fading to purple, sepals 4, unequal, concave, petals 4, 1 in. long, stamens many, longer than the petals, purple ; berry fleshy, ribbed, 1-3 ins. long, red inside when ripe. Buds and unripe fruit pickled as a condiment, and ripe fruit eaten raw.
Capparis aphylla, *Karil, kirra.* CAPPARIDACEÆ. F. B. I. i. 175. The Plains.	large, much branched, branches smooth, slender ; leaves (only on young shoots) $\frac{1}{6}$-$\frac{1}{2}$ in. long, slender, ending gradually in a sharp point, soon falling off, stipules two, sharp, straight spines ; flowers in short clusters on lateral short shoots, pinkish-yellow, 1 in. diam.; fruit $\frac{1}{2}$-$\frac{2}{3}$ in. long, smooth, long beaked, red when ripe. Buds and unripe fruit pickled as a condiment.
Capparis sepiaria, *Hiungarna, hius.* CAPPARIDACEÆ. F. B. I. i. 177. The Plains to 2,000 ft.	medium size, sometimes climbing, wiry, straggling, branches woolly, stem thorny ; leaves green, variable in shape, usually $\frac{3}{4}$-$1\frac{1}{4}$ ins. long, ovate, smooth above, downy beneath ; flowers $\frac{1}{3}$-$\frac{1}{2}$ in. diam., white, in clusters with stalks, radiating from one point, petals narrow oblong ; berry $\frac{1}{3}$ in. diam., round, black when ripe, one seeded.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Helicteres, Isora, East Indian Screw Tree,
Marorphali, kupasi.
STERCULIACEÆ.
F. B. I. i. 365.
The Plains.

large, thin spreading branches, bark grey, young shoots covered with stellate hairs ; leaves alternate in two opposite rows on the branchlets, 3-6 by 2-4 ins., round ovate, short pointed, rough above, velvety beneath, stipules $\frac{1}{4}$ in. long, linear ; flowers solitary, or two to four together in a cluster on a short stalk, axillary, 1-2 ins. long, calyx tubular, almost two lipped, crown woolly, petals 5, scarlet, 1 in. long, turned back, two lower much the largest, staminal tube 5 toothed at the apex, styles 5 ; fruit 2 ins. long, consisting of five spirally twisted woolly follicles on a long stalk. From the twisted fruit it is considered good for the twisting pain of colic.

Melhania, Hamiltoniana, var. abutiloides,
STERCULIACEÆ.
F. B. I. i. 373.
The Plains.

small, white felted, branches spreading, leaves 2-3 ins. long, roundish ovate, deeply heart-shaped, apex long, or short pointed unequally toothed, velvety on both surfaces, leaf stalk 1 in., stipules bristly, equal in length to the leaf stalk ; flowers yellow, 1-3 on axillary and terminal stalks, twice the length of the leaf stalks, bracteoles ovate-cordate, longer than the calyx, edges turned over, sepals 5, lanceolate, tipped with a sharp hard point, silky, petals 5, ovate with a broad tip, much longer than the sepals, withering before falling off, stamens 10, alternate ones fertile, united below into a very short tube, styles 5, united below ; capsule ovoid, shorter than the sepals, silky, 5-valved, seeds many, oblong.

Melhania futteyporensis,
STERCULIACEÆ.
F. B. I. i. 373.
The Plains.
T ret. Choa Saidan Shah Douie).

velvety, leaves oblong, long pointed, a little larger, bracteoles equal to the sepals, capsule a little shorter than the sepals ; otherwise like the last species.

Melhania tomentosa,
STERCULIACEÆ.
F. B. I. i. 373.
The Plains.

white felted, leaves smaller, oblong lanceolate, thinly hairy with stellate hairs above, flower stalks terminal, about equal to the leaves, bracteoles shorter than the sepals, edges not turned down, flowers much smaller, seeds rough, angled ; otherwise like the last species.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Grewia populifolia,
Ganger, shikari mewa.
TILIACEÆ
F. B. I. i. 385.
The Plains.
Rawulpindi.

medium size, much branched, stellately hairy on young parts ; leaves variable, $\frac{1}{2}$-1$\frac{1}{2}$ ins. long, leathery, small toothed, smooth, stalk $\frac{1}{2}$ in. ; flowers white on solitary or two-flowered stalks opposite the leaves, sepals $\frac{1}{2}$-$\frac{3}{4}$ in. long, petals notched, shorter than the sepals, stamens many, style one ; drupes yellowish two to four lobed, lobes size of a small pea, orange red, stones one to four, one to two celled, edible.

Grewia salvifolia,
Gargas, bather.
TILIACEÆ.
F. B. I. i. 386
The Plains,
Rawulpindi.

large, bark grey, white velvety on young parts ; leaves 2$\frac{1}{2}$ by 1$\frac{1}{2}$ ins., nearly smooth above, white-velvety beneath, margin smooth or minutely toothed, stalk $\frac{1}{4}$ in., stipules $\frac{1}{3}$ in., linear pointed ; flowers yellow on two inch stalks, clustered in twos or threes in the axils of leaves, sepals $\frac{1}{4}$ in., linear, petals $\frac{1}{6}$ in. divided, stamens many, style one ; drupe one to four lobed, small, not succulent, edible.

Grewia villosa,
Jalidar, thamther.
TILIACEÆ.
F. B. I. i. 388.
The Plains.

medium size, long soft hairs on young portions ; leaves 1-3 ins., nearly round, toothed, hairs on teeth, rough above, hairy beneath, stalk $\frac{1}{2}$-1 in., stipules broad leafy ; flowers dull yellow, sessile in dense clusters, sometimes opposite the leaves, sepals hairy, oblong, ending in an angle, petals oblong, shorter than the sepals, stamens many, style one ; drupe $\frac{1}{2}$ in. diam., round, hard brittle rind, hairy, copper colour, stones four, one to two seeded.

Grewia polygama,
Kukurbisha.
TILIACEÆ.
F. B. I. i. 391.
Salt range.
Himalayas, 2-4,000 ft.

medium size, stem short with spreading branches in two opposite rows ; leaves in two rows, 3-4 by $\frac{1}{2}$-$\frac{3}{4}$ in. nearly sessile, lanceolate, long pointed, sharply toothed, downy above, white-woolly beneath, stipules linear, sharp pointed ; flowers polygamous, mostly one sexual, in slender axillary stalks, sepals linear, hairy without $\frac{1}{6}$-$\frac{1}{4}$ in. diam., longer than the petals, stamens many, style one ; drupe $\frac{1}{2}$ in. diam., whitish-brown, shining sparsely hairy, somewhat four lobed, stones four, one seeded. Dr. Armit states that a decoction of the leaves cures dysentery quickly.

Triumfetta tomentosa, see Herbs, Alternate, Stipulate, Simple.

Triumfetta rhomboidea. see Herbs, Alternate, Stipulate, Simple.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Triumfetta rotundifolia, TILIACEÆ. F. B. I. i. 395. The Plains.	small, with rough stellately hairy herbaceous stems ; leaves $1\frac{1}{2}$ ins. long, nearly round, nearly smooth above, cream coloured, woolly beneath, leathery, unequally toothed ; flowers in irregular-spaced racemes, yellow, sepals with sharp points, white-woolly, petals 5, oblong hairy at the base, stamens 15-25, style thread like, stigma 5 toothed ; fruit globular, about the size of a pea, velvety with hooked spines with dilated bases, seeds 1-2 in each cell.
Reinwardtia trigyna, **and** **R. tetragyna,** **Bush flax,** *Basant, bal basant.* LINEÆ. F. B. I. i. 412. Himalaya, 3-6,000 ft. Rawulpindi. Hazara (Barrett).	small, tufted, erect, also with prostrate, stout, soft, rooting branches ; leaves 1-3 ins., narrowed into slender stalks, rounded and short pointed tips or lanceolate, long pointed with minute teeth, stipules minute, awl-shaped, and soon falling off ; flowers yellow in axillary or terminal clusters, sometimes solitary, 1 in. across, look like primroses, sepals 5, green, lanceolate, long pointed, petals 5, twisted, soon falling off, much longer than the sepals, stamens 5, united below with alternating staminodes, styles 3-4 ; capsule papery, size of a pea, much shorter than the sepals, splitting into 6-8 cells, seeds curved.
Zizyphus Jujuba,	see Trees, Alternate, Stipulate, Simple.
Zizyphus nummularia, *Jhar-beri.* Rhamnaceæ. F. B. I. i. 633. The Plains to 3,000 ft.	thorny, branches grey, branchlets in two rows, hairy when young ; leaves $\frac{1}{2}$-1 in. long, ovate to round, minutely toothed, dark green and velvety above, pale and densely woolly beneath, stipules are two prickles, one straight slender, the other bent down hooked ; flowers small, yellow-green in axillary short clusters, which are less than $\frac{1}{2}$ in., petals 5, bent down, stamens 5, styles 2-3 ; fruit round, red or black, fleshy, nearly $\frac{1}{2}$ in. diam., with a woody two-celled stone ; this sweet acid fruit is eaten.
Zizyphus vulgaris, *Sinjli.* RHAMNACEÆ. F. B. I. i. 633. The Plains to 6,500 ft. Hazara (Barrett). Rawulpindi.	large, branches spreading and stiff, often without thorns ; leaves $\frac{3}{4}$-$2\frac{1}{2}$ ins., ovate, unequal-sided, finely toothed, smooth on both sides, stipular prickles, two stout, one straight 1 in. long, the other curved ; flowers few, greenish, clustered, axillary, petals 5, hood-shaped, bent down, stamens 5, styles 2-3 ; fruit round or oblong, succulent, red or black shining.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Zizyphus oxyphylla, *Phitni.* RHAMNACEÆ. F. B. I. i. 634. Himalaya, 1-7,000 ft. Simla Mahasu (Collett). Hazara (Barrett). Rawulpindi.	medium size, bark brown, thin; leaves 1-2 by $\frac{3}{4}$-1$\frac{1}{4}$ in., ovate-lanceolate, sharp-pointed, finely toothed, thin, smooth, stalk slender, stipular prickles two, slender, one straight $\frac{1}{2}$ in. long, the other curved; flowers in clusters in axils of leaves, greenish, petals 5, stamens 5, styles 2; drupe $\frac{1}{4}$ in. long, ovoid, fleshy, 2 seeded, rarely one-seeded, black, very acid, stone thin, flattened.
Zizyphus Œnoplia, *Makoh.* RHAMNACEÆ. F. B. I. i. 634. The Plains.	medium size, bark rough, dark grey, branches long, straggling, often climbing, young parts covered with rusty velvet; leaves 1-2 by $\frac{3}{4}$-1 in., ovate-lanceolate, unequal sided, very slightly and minutely toothed, smooth above, rusty velvety beneath, stalk short, stout, stipular prickles solitary, very short, curved; flowers in short clusters, smooth within, calyx woolly without, petals 5, inversely triangular, hood shaped, bent down, stamens 5, styles 2, drupe $\frac{1}{4}$ in. diam., one or rarely two-celled, round or ovoid, black.
Berchemia floribunda,	see Climbing Shrubs, Alternate, Stipulate, Simple.
Berchemia lineata, RHAMNACEÆ. F. B. I. i. 638. Himalaya, 4-7,000 ft.	small, bark smooth, shining, young shoots minutely velvety; leaves $\frac{1}{4}$-1 in. long, ovate or nearly round, nearly sessile, stipules bristle-like, very small; flowers $\frac{1}{4}$-$\frac{3}{8}$ in., 2 or 3 clustered, axillary or terminal, petals 5, linear, lanceolate, stamens 5, style one; fruit ovoid $\frac{1}{5}$-$\frac{1}{4}$ in. long, succulent, blue, the base held by the calyx, two-seeded.
Berchemia Edgeworthii, RHAMNACEÆ. F. B. I. i. 638. Himalaya 7-8,000 ft.	small, very like the last species, but with smooth branches, larger leaves, flowers with six petals, stipules $\frac{1}{4}$ in. long, and fruit $\frac{2}{3}$ in. long.
Rhamnus persicus, *Nikki kander.* RHAMNACEÆ. F. B. I. i 638. Salt range. Himalaya, 2-5,000 ft.	large, trunk short, ash coloured, with stiff, often spinous branches; leaves $\frac{1}{2}$-2 ins., clustered, when on arrested branchlets, ovate, or oblong, toothed or not, woolly beneath, shortly stalked, stipules minute, soon falling; flowers few, shortly stalked in axillary clusters, calyx lobes 4, petals 4, small, linear, stamens 4, style 4 branched; fruit $\frac{1}{3}$ in. diam., top shaped, 2-4-celled, held below by the calyx.

. SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Rhamnus dahuricus, vel virgatus,	see Trees, Alternate, Stipulate, Simple.
Rhamnus purpureus,	see Trees, Alternate, Stipulate, Simple.
Rhamnus triqueter, *Gaunt, gudlei, phulla.* RHAMNACEÆ. F. B. I. i. 639. Himalaya, 3-5,006 ft. Salt range. Valleys below Simla (Collett). Hazara (Barrett).	medium size, not thorny, bark roughish, dark grey, thin, with elevated dots ; leaves 3-6 by 1-2½ ins., ovate-oblong, long pointed, finely toothed, smooth above, finely velvety beneath, stalk ¾ in. long, stipules minute, soon falling ; flowers greenish in clusters on long branches of axillary racemes, which are 2-4 ins. long, calyx lobes 5, triangular, petals 5, stalked, broad and notched at the apex, stamens 5 style 3-4 cleft ; fruit three-lobed, rarely three-cornered, ⅛ in., seeds grooved.
Sageretia Brandrethiana, *Ganger, bajan.* RHAMNACEÆ. F. B. I. i. 642. The Plains, west of the Jhelum, Peshawar. Salt range. Hazara (Barrett).	small, branches many, spinous ; leaves nearly opposite, ¾-1 in. oblong with rounded ends, slightly toothed, smooth above, covered with dense white wool beneath, stalk very short, stipules small, soon falling ; flowers minute in terminal and axillary branching racemes, calyx 5-fid, petals 5, stalked, hooded, stamens 5, stigmas 3 ; fruit ovoid, ¼ in. diam., succulent, three-lobed, black, three-seeded, edible, sweet like the bilberry.
Crotalaria alata, LEGUMINOSÆ. F. B. I. iii. 69. The Plains to 5,000 ft.	small, densely hairy ; leaves 2-3 ins. long, nearly sessile, ovate-oblong, tip rounded, thin, stipules forming wings running down the stem, persistent ; flowers in 2-3 flowered racemes on long, often leafy, lateral stalks, small, ⅜ in. long, calyx silky, 2-lipped, petals 5, pale yellow, hardly protruding from calyx, stamens 10 in one bundle, style long-bearded above ; pod long stalked, linear-oblong, smooth, 1¼-1¾ ins. long, seeds 30-40.
Crotalaria sericea, *Sanni.* LEGUMINOSÆ. F B. I. ii. 75. The Plains to 4,000 ft. Valleys below Simla (Collett).	medium size, silky velvety, stem thick grooved ; leaves 2-6 by 1-3 ins., nearly sessile, ovate, tapering to the short stalk, tipped with a minute bristle, stipules small, leafy, persistent ; flowers ¾-1 in. long in terminal racemes 20-40 flowered and 8-12 in. long, calyx ½ in. long, teeth lanceolate, petals yellow, nearly twice as long as the calyx, stamens and style

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

	like the last species ; pod 1½-2 ins. long, nearly smooth, stalked, seeds many.
Crotalaria juncea,	see Shrubs, Alternate, Exstipulate, Simple.
Taverniera nummularia,	see Shrubs, Alternate, Stipulate, Compound, Leaflets Three.
Uraria lagopus,	see Shrubs, Alternate, Stipulate, Compound, Leaflets Three.
Alysicarpus vaginalis,	see Prostrate Shrubs, Alternate, Stipulate, Simple.
Alhagi maurorum or camelorum, *Jawasa.* LEGUMINOSÆ. F. B. I. ii. 145. The Plains. Salt range. Kashmir to 3,000 ft.	small, with many axillary hard sharp thorns ½-1 in. long ; leaves ¼-½ in. long, ovate-oblong, tip rounded with a fine bristle, leathery, stiff drooping from the base of the spines or branchlets, stipules minute, awl-shaped ; flowers reddish, on short stalks 1-6 from a spine, calyx $\frac{1}{12}$-⅛ in., smooth, corolla nearly ½ in., stamens 10 in 2 bundles of one and nine ; pod about 1 in. long, curved, constricted between the seeds, smooth, seeds 6-8. Manna, a sugary gum, exudes when the leaves appear, and forms small tears, which are shaken off and eaten. This manna does not appear on the plants in India, but in Afghanistan and Persia.
Desmodium gangeticum, *Salpan.* LEGUMINOSÆ. F. B. I. ii. 168. The Plains to 5,000 ft.	small, woody, slightly angular stems, branches grey-felted ; leaves 3-6 by 1½-3 ins., oblong, rounded at the base, smooth above, grey-haired beneath, stalk ½-1 in., stipules ¼ in linear ; flowers ⅕ in., white or lilac, in crowded axillary and terminal racemes, 6-12 ins., long, calyx minute, teeth 5, lanceolate, petals 5, projecting outside the calyx, standard petal broad, wing petals 2, adhering to the two united petals (keel), stamens 10, one free, 9 united, style incurved at the end ; pod ½-¾ in. long, curved, lower border deeply indented, joints 6-8, one-seeded, covered with minute hooked hairs. The plant is used in native medicine.
Desmodium latifolium, LEGUMINOSÆ. F. B. I. ii. 168. The Plains to 4,000 ft.	like the last, but more erect, branches brown-felted; leaves ovate, thicker, brown-felted beneath ; flowers purple, joints of pod 4-6.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Prunus prostrata,
Paltu, tára, ter.
ROSACEÆ.
F. B. I. ii. 313.
Himalaya, west of Sutlej, 5-10,000 ft.

medium size, scraggy ; branches grey, spreading, erect or prostrate ; leaves ½-1 in., ovate-oblong, rounded tip, toothed, smooth above, white and woolly beneath, narrowed into the short stalk flowers red, nearly sessile, solitary or clustered, appearing with the leaves, calyx tube ¼ in., cylindric with 5 oblong blunt lobes, petals 5 round, longer than the calyx, stamens many, style one ; fruit ⅓ in., ovoid, purplish-red, hardly edible, dry, stone one.

Prunus tomentosa,
ROSACEÆ.
F. B. I. ii. 314.
Kashmir, 5-6,000 ft.

medium size, branches slender, spreading, branchlets woolly ; leaves 1-1½ ins., ovate-round, long-pointed, finely toothed, slightly hairy above, densely softly hairy beneath, stalk very short, hairy, stipules slender segmented ; flowers axillary, shortly stalked, solitary, calyx-tube ¼ in., lobes oblong, pointed, petals small, white ; fruit scarlet, oblong, hairy, pointed at first, blunt, flattened when ripe.

Prinsepia utilis,
Bekhar, bekhal.
ROSACEÆ.
F. B. I ii. 323.
Himalaya, 4-8,000 ft.
Simla, Mashobra (Collett).
Hazara. (Barrett).

medium size, straggling, smooth, spinous, spines often leafy, green, pith divided by partitions ; leaves 1½-5 by ½-1⅕ ins., narrow lanceolate, long pointed leathery, smooth, minutely toothed, dark green, stalk ⅕-½ in., stipules minute, soon falling off ; flowers white, ¼ in. diam. in short axillary racemes, petals 5, round, stamens many in several rows ; drupe ½-⅔ in. oblong, the minute point, the remains of the style, is quite on one side, purple with bloom like a plum, stone smooth, one-seeded. Oil expressed from the seeds is used locally for food, illuminating and as an external remedy in rheumatism.

Spiraea bella,
Kurkan
ROSACEÆ
F. B. I. ii. 324.
Himalaya, 6-12,000 ft.
Simla, Mahasu, common (Collett).

medium size, branches erect, arching slender or stout ; leaves ⅓-2 ins. long, broadly oblong, ovate, sharply irregularly toothed towards the tip, dark green above, bluish green below, stipules small, soon falling off ; flowers pink, rarely white, in broad terminal much branching clusters, petals round, stamens 50-60 ; fruit of 5 carpels, velvety, carpel ⅙in., dark brown.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Spiraea canescens,
Chakis.
ROSACEÆ.
F. B. I. ii. 325.
Himalaya, 6-12.000 ft.
Simla, Mashobra, common (Collett).

medium size, softly hairy or velvety, branches grey arching, densely leafy ; leaves ½-⅔ by ⅕-½ in., ovate with tip broad, nearly sessile, toothed towards the tip, rather leathery, stipules small, soon falling off ; flowers white or pinkish, ⅕in. diam., in small branched clusters at the end of many lateral branchlets, often all turned to one side, carpels 5, hairy. when ripe, and partially sunk in the calyx.

Spiraea vacciniifolia,
ROSACEÆ.
F. B. I. ii, 325.
Himalaya, 6-8,000 ft.
Simla, Elysium Hill, Naldera, Shali (Collett).
Hazara (Barrett.)

medium size, branches stiff grey hairy ; leaves 1-1½ in. stalked ovate, minutely toothed towards the tip. stipules small, soon falling off ; flowers white, ⅙in. diam. in broad terminal branching woolly clusters ; carpels 5, when ripe smooth, minute, half sunk in the hairy calyx.

Cydonia vulgaris, The Quince,
Bihi.
ROSACEÆ.
F. B. I ii. 369.
The Plains to 5,500 ft.

medium size, bark black, branches many ; leaves with smooth margin, stipules ovate, uneven-sided : flowers solitary, white or pink, large, woolly, bracts leafy, toothed, sepals club-shaped, large, spreading. toothed, petals 5, stamens 20, styles 5 ; fruit like an apple, dented at the top and bottom, firm, fleshy astringent, fragrant, 5 celled, seeds many. The seeds, Bihidanah or Behdanah, are used as a demulcent in dysentery in native practice, and an oil is also expressed from the seeds.

Cratægus crenulata,
Gingaru.
ROSACEÆ.
F. B. I. ii 384.
Himalaya, 2,500-8,000 ft.

large, spiny, rigid, evergreen, leaves 1-2 ins., linear-oblong, obtuse, minutely toothed, shining, very leathery, stipules soon falling off ; flowers white, ¼-⅓in. diam. on slender stalks in short, many-flowered clusters at the end of branchlets, calyx lobes 5, obtuse, petals 5, round, stalked, stamens many, carpels five ; drupe round, ¼ in. diam. orange-red. crowned with the calyx, five bony one-seeded nutlets.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Cotoneaster bacillaris,
Reus, kherbaba.
ROSACEÆ.
F. B. I. ii. 384.
Salt range, 1,500-2,500 ft.
Himalaya, 4-10,000 ft.
Simla, Mashobra. (Collett.)
Murree.
Hazara. (Barrett.)

large, bark bluish-grey, branches long slender, used for walking-sticks, hence the specific name ; leaves 1-3½ by ¾-1¾ ins., ovate or oblong-lanceolate, sharp or blunt-pointed, narrowed into the stalk, smooth above, downy beneath, margin flat, stalk ¼ in., stipules minute, bristle-like, very soon falling off ; flowers white, ⅓ in. diam., in large hairy or downy branched-clusters on short lateral leafy branchlets, calyx smooth, 5 toothed, petals 5, round, stamens 20, styles 2-5, free ; fruit round, ¼ in. diam., two-celled, dark brown to black, crowned by the calyx. Variety—*C. affinis* or rosea like the above, but woolly under the leaves and on the calyx, petals pink.

Cotoneaster acuminata.
Dev-reus, rauns.
ROSACEÆ.
F. B. I. ii. 385.
Himalaya, 4,500-12,000 ft.
Hattu (Collett).
Chor Peak.

large, bark shining, dark bluish-grey, branches long, slender ; leaves 1-2½ by ¼-¾ in., ovate-lanceolate, long pointed, silky beneath, margin hairy, flat, stipules minute, bristle-like, soon falling off ; flowers white, ¼ in. diam., solitary or in hairy small, nearly sessile clusters on short lateral leafy branchlets, calyx 5-toothed, reddish inside, petals 5, round, stamens 20, styles 2-5 ; fruit top shaped, ⅓ in. long, bright red when ripe, crowned by the calyx.

Cotoneaster nummularia.
ROSACEÆ.
F. B. I. ii. 386.
Kashmir, 6-11,000 ft.

small, straggling, nearly prostrate, branches thick, woody, dividing widely ; leaves ⅓-1½ ins., round or with the blade wider at the tip, white or densely woolly beneath, falling off in the winter, stipules minute, bristle-like, soon falling off ; flowers white, small, in crowded very short woolly two to five-flowered clusters, calyx usually woolly, petals 5, round, stamens 20, styles 2-5 ; fruit small, round, black, crowned by the calyx.

Cotoneaster microphylla,

see Prostrate, Shrubs, Alternate, Stipulate, Simple.

PETALS UNITED.

Sida spinosa,

see Herbs, Erect, Alternate, Stipulate, Simple Toothed.

Sida grewioides,

see Herbs, Erect, Alternate, Stipulate, Simple Entire.

Shrubs with Alternate Stipulate Simple Leaves.

Petals United.

Sida rhombifolia	see Herbs, Erect, Alternate, Stipulate, Simple, Toothed.
Sida cordifolia,	see Herbs, Erect, Alternate, Stipulate, Simple, Toothed.
Abutilon graveolens,	see Herbs, Erect, Alternate, Stipulate, Simple, Entire.
Hibiscus hirtus,	see Shrubs, Alternate, Stipulate, Lobed.
Hibiscus Rosa sinensis, **Shoe flower,** *Jasum, angharæ-hindi.* MALVACEÆ. F. B. I. i. 344. The Plains to 5,000 ft.	medium size, woody, branched, not prickly ; leaves ovate, long pointed, nearly smooth, toothed at the apex, stipules sword-shaped ; flowers red, 3 in. diam., on stalks longer than the leaves, axillary, bracteoles 6-7, linear, half the length of the calyx, calyx bell-shaped, sepals $\frac{3}{4}$ in., lanceolate, united below the middle, corolla of 5 petals, united to the staminal tube, staminal tube longer than the corollas, and of many filaments, styles 5, spreading ; capsule roundish many seeded, but does not seed in India. The petals were used to blacken shoes, hence the name, Shoe flower.
Plumbago zeylanica,	see Herbs, Erect, Alternate, Stipulate, Simple, Entire.
Jatropha curcas, *Rattanjot, japhrota.* EUPHORBIACEÆ. F. B. I v. 383 The Plains and Himalaya to 3,000 ft.	large, bark grey, smooth, peeling in papery flakes, young parts hairy, juice milky, leaves 4-6 by 3-5 ins., broadly heart-shaped often 5-lobed, stalk 3-9 ins. long, stipules with stiff hairs ; flowers yellow in terminal clusters, sepals 5, yellowish, corolla tubular, pale yellow, hairy within, lobes 5, in males stamens many, in females styles united 2-fid ; capsule 1-1$\frac{1}{2}$ ins. long, 3-lobed, oblong, seeds large, dark brown, smooth, oblong, purgative. The juice is sometimes used to stop bleeding and cure spongy gums.

Petals None.

Parrottia Jacquemontiana, *Kilir poser.* HAMAMELIDACEÆ. F. B. I ii. 426. Kashmir, 5-9,000 ft. common. Murree (Douie). Hazara (Barret).	large, stem stout, branches many, very like a hazel (*Corylus colurna*) ; leaves 2-3 ins. diam., appearing with the flowers, round or broad oblong, blunt, minutely toothed, stalk $\frac{1}{3}$ in. long, stipules large, soon falling off, flowers very small, greenish-white, in sessile round heads, involucral bracts petal-like, yellowish-white, $\frac{3}{4}$ in. long, ovate with broad tips, calyx lobes 5-7, minute, woolly, oblong or linear-narrow,

petals none, stamens 5-7, styles 2 ; capsules minute, in round heads, 1-1½ ins. diam., woolly, splitting from the top, outer coat woody, inner coat horny, separating from the outer, seed narrow, oblong, with rounded ends. The twigs are used for basket-making and form the twig bridges of Kashmir.

Casearia graveolens,
Chilla, naro, pimpri.
SAMYDACEÆ.
F. B. I. ii., 592.
The Plains, east of Chenab, to 5,000 ft.

large, bark dark grey with white specks, branchlets smooth ; leaves 4-8 by 2½-4 ins., oblong, with rounded ends or acute, minutely toothed, stalks ⅕-½ in. long, stipules ½ in. long, soon falling off ; flowers greenish yellow, smooth, many clustered in the axils of leaves, calyx 5 lobed, slightly velvety at the base, persistent, petals none, stamens 8, alternating with scales, style one, stigma simple or 3-fid ; capsule ¾ in., three valved, oblong, smooth, seeds with a fleshy coat. The fruit is thrown into streams or tanks to poison fish.

Casearia tomentosa,
Chilla, bairi.
SAMYDACEÆ.
F. B. I. ii 593.
The Plains to 3,000 ft.
Suni.
Sutlej Valley (Collett).
Kahuta, Letrar (Douie).

large, bark light grey to dark brown, branchlets hairy ; leaves 3-7 by 1¾-3 ins , oblong, hairy, minutely toothed, stalks short, stipules minute, soon falling off ; flowers hairy, greenish yellow, many clustered in the axils of leaves, calyx four to five segments, hairy, petals none, stamens 8, alternate with hairy scales, style one, stigma simple or 3-fid ; capsule three-valved, ¾ in. long, fleshy, yellow, six-ribbed when dry ; seeds with a red coat. The fruit is used as a diuretic.

Calligonum polygonoides,
Phog, Phok.
POLYGONACEÆ.
F. B. I. v. 22.
The Plains.
The Salt Range, 2,000 ft.

large, branches many, slender, pale, nearly leafless ; leaves linear minute, stipules (ochrea) short ; flowers solitary or few, with sheaths, stalks ⅛-⅙ in., sepals 5, flat broad, red with broad white edges, stamens 12-18: nuts oblong, 4-angled, hard, ½-1 in. diam., covered with many reddish brown stiff bristles, seed 4-angled. The flowers are cooked and eaten.

Polygonum chinense,
POLYGONACEÆ.
F. B. I. v. 44.
Himalaya, 4-8,000 ft.
Simla.
The Glen (Collett).

medium size, rambling, stems and branches many, changing their course in a curve from joint to joint, angled, finely grooved ; leaves 5 by 1½ ins., rough with minute prickles, oblong-lanceolate, long pointed, stalks shortly winged above, sometimes two-eared at the base, stipules ¾ in. long, tubular, white with long waving points ; flowers white or pink, in heads ¼-½ in. diam., on stalks forming a large level cluster, bracts flat, ovate, sepals 5, stamens 8, style 3, united half way up ; nuts 3-angled, black, enclosed in the dry or fleshy calyx.

Polygonum polystachyum,
Amldandi, tror.
POLYGONACEÆ.
F. B. I. v. 50.
Himalaya, 7-12,000 ft.
Mattiana.
Narkanda (Collett).

medium size, stems angled hairy, densely hairy at the ends of branches ; leaves 4-9 by 1¼-3½ ins., oblong-lanceolate, lower stalked or the upper nearly sessile, long pointed, upper surface thinly hairy or smooth, lower densely hairy, stipules tubular, very long, hairy, pointed ; flowers ¼ in. diam., white or pinkish, in terminal branching racemes 6-18 ins. long, bracts flat, short, blunt, sepals 5, spreading, three inner broadest, two outer narrow, stamens 8, styles 3, only joined below ; nuts small, 3-angled, pale brown, not closed up tight in the calyx. The leaves and shoots are cooked and eaten.

Polygonum tortuosum,
Niâla.
POLYGONACEÆ.
F. B. I. v. 52.
Himalaya, 9-16,500 ft.
Lahoul.

small, branches widely separating with joints like knees, smooth, shining, red brown ; leaves 1-2 ins. long, pale green, turning red, sessile leathery, from oblong to round, blunt or acute, stipules tubular, short, with the end cut off ; flowers ⅛ in. long on very short velvety stalks in dense branching, racemes ½-1 in. long, calyx lobes oblong, erect, nut pale, 3-angled, ovate included in the calyx. The plant is used in Lahoul for dyeing cloth a yellow colour.

Piper brachystachyum,

see Climbers, Alternate, Stipulate, Simple.

Euphorbia nivulia,
Senhúr, Thura.
EUPHORBIACEÆ
F. B. I. v. 255.
Himalaya to 3,000 ft.

large, smooth, fleshy, branches nearly cylindric in groups of four, juice milky, copious , leaves 6-12 ins., linear tip rounded, or ovate oblong with broad and rounded tip, fleshy, smooth, stipules of two prickles on one tubercle, tubercles spirally or vertically arranged ; flowers in clusters of three, consisting of bracts with stamens and in the centre a stalked 3-celled capsule often hanging over, styles 3-branched the capsule ¼ in. broad divides into three cells, one smooth seed in each cell.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS NONE.

Euphorbia antiquorum, *Jidhara-sehud* EUPHORBIACEÆ. F. B. I. v. 255. The Plains to 2,000 ft.	large, smooth, fleshy, branches cylindric or somewhat angled, branchlets with three to five wavy wings, juice milky; leaves few, small, on the sides of the wings, the wings ovate oblong with broad rounded tips, fleshy, shortly stalked; stipules are two thorns; flowers $\frac{1}{2}$ in. broad, yellow in bracteate clusters, outer flowers stalked, inner sessile, bracteoles many, fringed flowers otherwise like the last species; capsule $\frac{1}{2}$ in. diameter, cells flattened, smooth.
Euphorbia Royleana, *Thor.* EUPHORBIACEÆ. F. B. I. v. 257. Salt range and Himalaya to 6,000 ft.	large, fleshy, smooth, branches straight, erect, 5-7 angled, the angles are wavy wings, the branches grow in clusters close to each other giving it the name of Candelabra tree; leaves 4-6 ins. long, along the angles of the branches, soon falling off, sessile, broad and rounded narrowing to the base, fleshy, smooth, stipules are two prickles; flowers $\frac{1}{2}$ in. diam., yellow, in sessile axillary clusters, lobes four, broad and round, fringed, flowers otherwise like the previous species of Euphorbia, capsules $\frac{3}{4}$ in. diam., 3-angled, stalks $\frac{1}{4}$-$\frac{1}{2}$ in. long.
Phyllanthus parvifolius, EUPHORBIACEÆ. F. B. I. v. 294. Himalaya, 5-6,000 ft. Naldera. Theog (Collett).	small, bark pale, foliage feathery, branchlets look like pinnate leaves; leaves $\frac{1}{4}$-$\frac{1}{3}$ in. in two rows, sessile, oblong, base narrow, tip rounded, pale below, stipules triangular, very minute, slender tapering to a point; flowers male and female, minute $\frac{1}{30}$ in. brown purple, stalked, solitary, axillary, sepals 6, oblong, blunt in males. stamens 3, rarely 5; in females, styles 3; capsule $\frac{1}{8}$ in. diam. round, somewhat lobed with a hard and brittle smooth, shell, seeds minutely marked with brown, smooth.
Phyllanthus simplex, EUPHORBIACEÆ. F. B. I. v. 295. The Plains and Himalaya to 5,000 ft. Valleys below Simla (Collett).	small, branches slender flattened, leaves $\frac{1}{3}$-1 in linear-oblong, in two rows, rather leathery, pale below, nearly sessile, stipules target-shaped, with wedge-shaped lobes at the base, fringed or smooth; flowers male and female, minute, $\frac{1}{30}$ in., brown purple, often three together, sepals 6, in males, broadly oblong,

stamens 3, in females styles 3, reflexed ; capsule $\frac{1}{10}$ in. indented, round, smooth, with a hard and brittle shell, seeds rough.

Baliospermum axillare,
Dánt nakun.
EUPHORBIACEÆ.
F. B. I. v. 461.
Himalaya, 2-3,000 ft.
Kashmir.

medium size, stem stout, branching from the base, nearly smooth ; leaves upper 2-3 ins., small, lanceolate lower 6-12 ins., large, oblong, ovate or rounded, sinuate toothed or 5-lobed, stalk thick, of upper leaves short, of lower as long as the blade, stipules of two glandular processes ; flowers males and females in many axillary racemes, small, in males sepals 4-6, orbicular, stamens 10-30, in females sepals 5-6, lanceolate, styles 3, 2-fid ; capsule $\frac{1}{3}$-$\frac{1}{2}$ in. long, of three two-valved cells, seeds oblong, smooth, mottled. The oil from the seeds and the powdered seeds are used in native medicine as a drastic purgative.

Plecospermum spinosum,
EUPHORBIACEÆ.
F. B. I v. 491.
Salt Range and Himalaya to 3,000 ft.

large, bark smooth, yellowish-brown, spines axillary, straight, thick ; leaves 2-3 ins. long, oblong with rounded ends or tip broad, blunt or short pointed, margin smooth, surfaces smooth, stipules minute, stalk short $\frac{1}{6}$-$\frac{1}{3}$ in.; flowers male and female in axillary stalked round heads, solitary or two or three together, male heads $\frac{1}{4}$ in. diam., bracteolate, sepals 4, concave blunt, stamens 4, female heads $\frac{1}{2}$ in. diam , sepals 4, fleshy ; fruit one to two seeded, lobed, berry $\frac{1}{2}$ in. diam., velvety.

Ficus clavata,
URTICACEÆ.
F. B. I v. 520.
Himalaya to 4,500 ft.
Basantpur (Collett).

large, shoots rough ; leaves 4-8 ins. long, oblong, long pointed, smooth, toothed, stalks $\frac{1}{5}$-$\frac{1}{3}$ in., stipules $\frac{1}{3}$ in. lanceolate ; fruit a fig, round with a knob, or ovoid and broad at the top, $\frac{1}{2}$ in. diam., uneven surface, axillary, solitary, stalk $\frac{1}{5}$ in. long.

Ficus palmata,

see Shrubs, Alternate, Stipulate, Lobed.

Boehmeria platyphylla,

see Shrubs, Opposite, Stipulate, Simple.

Pouzolzia viminea,
URTICACEÆ.
F. B. I. v. 581.
Himalaya to 5,000 ft.

large, bark rough, grey, thin stringy, branches slender, branchlets velvety or with hairs, stiff, and lying in lines ; leaves $\frac{1}{2}$-5 by $\frac{1}{5}$-$1\frac{1}{4}$ ins., oblong or lanceolate toothed, long pointed, smooth or slightly hairy above

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS NONE.

	hairy grey felted beneath, base 3-nerved, stalk $\frac{1}{2}$-2 ins. long ; flowers in sessile dense axillary rounded clusters, in males calyx 3-5 lobed, stamens 4, in female calyx tubular 3-5 lobed, style slender ; achenes, enclosed in the calyx, angled and margined.
Villebrunea frutescens, *Ga-fushiara poidhaula.* URTICACEÆ. F. B. I. v. 590. Valleys below Simla (Collett).	large, bark dark grey, rough, branches very slender, slightly velvety ; leaves 2-8 by 1-4 ins. ovate, long tail-like point, minutely toothed, except at base, 3-nerved at base, rough above, pale or white felted below, stalks slender, $\frac{1}{2}$-4 ins. long, stipules $\frac{1}{2}$ in., lanceolate, velvety ; flowers male and female crowded in bracteolate, small sessile, or nearly sessile clusters in axils of previous year's leaves, in males calyx 4-5-fid, stamens 4-5, in females calyx ovoid narrowed to a minute mouth, stigma linear ; achenes many, black, minute, partially inserted in a white juicy mass of the calyx and bracteoles. This plant yields a strong fibre.
Debregeasia hypoleuca, *Puruni, siàrú.* URTICACEÆ, F. B. I. v. 591. Salt Range and Himalaya, 3-5,000 ft. Simla, Mahasu (Collett). Kotzi, Murree Hills (Donie).	large, bark thin, dark grey, branches white woolly ; leaves narrow, 3-6 by $\frac{1}{2}$-1$\frac{1}{4}$ ins., linear-lanceolate, long pointed, toothed, bases 3-nerved, rough above, white woolly beneath, stalks $\frac{1}{10}$-1 in., stipules divided ; flowers male and female in rounded sessile axillary heads, bracteolate, in males sepals 4, shorter than the bracteoles, stamens 3-5, in females calyx fleshy, ovoid, mouth contracted, minute ; fruit yellow, $\frac{1}{3}$ in. diam., fleshy dotted with the minute achenes. This plant yields a strong fibre.
Quercu Ilex, *Baloot, kharanja.* CUPULIFERÆ, F. B. I. v. 602. Himalaya, 3-8,500 ft.	large, shoots stellately velvety ; leaves 1-3 ins., very leathery, oblong or orbicular, margin smooth or spinous-toothed, velvety above when young, woolly or very velvety beneath, or smooth when old, nearly sessile, stipules soon falling off ; flowers minute, in slender short clustered spikes, males in pendulous spikes, calyx bell-shaped, 4-7-lobed, stamens 6-12, females in erect spikes, enclosed in bracts, calyx minutely toothed, styles 3-5 ; acorn cylindric, 1-1$\frac{1}{2}$ ins. long, tip conical, cup very thick, grey, bracts closely fitting, tips narrow.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNITED.

SEEDS WHITE, DOWNY.

Salix Wallichiana,
Bwir, bhains.
SALICINEÆ.
F. B. I. v. 628.
The Plains to 9,000 ft.
Simla, Mahasu,
Fagu (Collett).

large, bark greenish grey, young parts velvety or woolly becoming nearly smooth ; leaves 2-5 ins. long, lanceolate, long-pointed, margins usually even, green and hairy above, white silky velvet beneath, nearly sessile ; flowers in spikes hanging or erect, 1-4 ins. long. appearing before the leaves, 1-3 leaves at the base, bracts black, male spikes 1 in. long, stout, stamens 2, female spikes 3-5 ins., style forked ; capsules $\frac{1}{4}$ in. downy, slender, shortly stalked, stigmas erect, nearly sessile.

Salix elegans,
Bail, bitsu, bada.
SALICINEÆ.
F. B. I. v. 630.
Himalaya, 6-11,000 ft.
Jaku, Simla (Collett).

large, branches dark green, young parts grey velvety ; leaves 1-3, ovate or oblong, pointed or blunt, finely toothed or not, smooth above, pale beneath, shortly stalked, often attacked by an orange fungus ; flowers appearing after the leaves on leafy spikes, $1\frac{1}{2}$-5 ins. long, bracts yellow, velvety, male spikes compact, stamens 2, female spikes slender, drooping much longer, stigmas nearly sessile, divided ; capsules $\frac{1}{6}$ in., conical, shortly stalked, smooth.

Salix hastata,
SALICINEÆ,
F. B. I. v. 630.
Himalaya, 9-15,000 ft.
Hathu Marali (Collett).

small, shoots silky, branches dark brown or black ; leaves 1-3 by $\frac{3}{4}$-2 ins., acute or abruptly pointed, teeth small, stalk $\frac{1}{4}$-$\frac{1}{2}$ in., stipules large, broadly ovate. flowers appearing with the leaves, in nearly sessile spikes, with small leaves at the base, 1-7 ins. long, silky, bracts oblong, blunt, just visible in the long silky hairs, male spikes 1-$1\frac{1}{2}$ in. long, compact, cylindric, stamens 2, female spikes 2-7 ins. long, style thread-like, stigmas divided, spreading, fruiting spikes 7 ins.; capsules smooth, nearly sessile, $\frac{1}{6}$-$\frac{1}{4}$ in. long, ovoid, beaked.

Salix viminalis,
The Osier,
Bitsu.
SALICINEÆ,
F. B. I. v. 631.
Himalaya, 5-9,000 ft.

large, branchlets slender, flexible, leaves 4-5 ins., lanceolate, long pointed, smooth above, silvery silky beneath, margins even, turned over, stipules linear-lanceolate ; flowers appearing before the leaves, in bright yellow nearly sessile spikes, 1-4 ins. long. bracts tipped with brown, or black silky hairs, male spikes nearly sessile, 1 in. long, erect, stamens 2, female spikes 2-4 ins. long, style slender, stigmas, slender spreading ; capsules $\frac{1}{4}$ in., beaked.

SHRUBS WITH ALTERNATE STIPULATE SIMPLE LEAVES.

PETALS UNITED.

SEEDS WHITE, DOWNY.

Salix oxycarpa,
SALICINEÆ.
F. B. I. v. 636.
Himalaya 6-11,000 ft.
Simla.

large, shoots velvety at first; leaves 2-4 by $\frac{3}{4}$-$1\frac{1}{4}$ ins., lanceolate, pointed, teeth small, or none, smooth above, greenish blue beneath, stipules small, semi-lanceolate; flowers appearing before the leaves, on very long, stout sessile spikes, bracts yellow in males or brown in females, in males stamens 2, united below, in females style very short, stigmas short; capsules large $\frac{1}{10}$ in., sessile, silky.

SHRUBS WITH ALTERNATE STIPULATE LOBED LEAVES.

Hibiscus hirtus,
MALVACEÆ.
F. B. I. i. 335.
The Plains.

medium size, cultivated; leaves 3 by 2 ins., ovate, long-pointed, lower leaves often three-lobed, toothed, hairy, stalk 2 ins., hairy, stipules $\frac{1}{2}$ in., linear; flowers $\frac{1}{2}$ in. diam., pink or white, spreading on long-jointed stalks, calyx lobes 5, not distended, linear-lanceolate, bracteoles 5-7, awl-shaped without appendages, shorter than the sepals, corolla $\frac{1}{2}$ in. diam., petals 5, joined with the staminal tube, which is 5 toothed; capsule 5 valved, round, shorter than the calyx, seeds cottony. This plant yields a strong fibre.

Hibiscus syriacus,
Gurhal,
MALVACEÆ,
F. B. I. i. 344.
The Plains.

medium size, cultivated, not prickly; leaves 2 ins. long, ovate, three-lobed, toothed, surface nearly smooth, stalk short; flowers large showy on stalks equal to the leaf stalk, axillary, bracteoles 6-7, linear half the length of the calyx, sepals 5, ovate, lanceolate, petals 5, broad at the tip, longer than the calyx, staminal tube with anthers all the way up; capsule oblong, blunt, slightly hairy, seeds thinly hairy. This plant yields a strong fibre.

Gossypium herbaceum, Cotton,
Kapas,
MALVACEÆ.
F. B. I. i. 346.
The Plains to 5,000 ft.

medium size, cultivated, hairy or nearly smooth; leaves heart shaped, three to seven-lobed, lobes broadly ovate, long-pointed, long-stalked, stipules ovate-lanceolate, margin smooth or toothed; flowers yellow with a purple centre or all yellow or all purple on axillary jointed single-flowered stalks, bracteoles three, large leafy heart-shaped, not divided below the middle, calyx cup-shaped, petals 5, spreading, staminal tube 5-toothed, style with 5 stigmas; capsule ovate 3-5 valved, seeds 5-7 in each cell, ovoid, cotton white rarely brownish, adherent to the seeds and overlying a greenish down. This plant is of Indian origin and is cultivated to yield cotton.

Gossypium barbadense,
MALVACEÆ.
F. B. I. i. 347.
The Plains to 5,000 ft.

medium size, branches and leaves black-dotted, branches purple ; leaves 3-5 lobed, lobes oblong, long-pointed, nearly smooth, long-stalked, stipules linear lanceolate ; flowers, yellow with a purple spot, on thick stalks, axillary, jointed, single flowered, bracteoles 3, very large, deeply cut, leafy, cordate, calyx as in last species, petals with one margin within and one without the next one, staminal tube and style like the last species ; capsule oval, long pointed, 3-5 celled, seeds black, covered with easily separable white or brownish cotton. This plant, as its name implies, was introduced from America, and is grown to yield cotton.

Gossypium arboreum,
MALVACEÆ.
F. B. I. i. 347.
The Plains to 5,000 ft.

large, perennial, branches purple with scattered hairs ; leaves nearly smooth, deeply 5-7 lobed, lobes linear-oblong contracted at the base, long stalked, stipules sword-shaped ; flowers large purple rarely white on axillary, jointed, single flowered stalks, bracteoles 3, large, heart-shaped, ovate, pointed, leafy, nearly undivided, calyx as in the last species, petals spreading, staminal tube and style as in the last species ; capsule about one inch long, oblong-pointed, seeds covered with adhering white cotton over a dense green down. This plant is of Indian origin and only grown to a limited extent in gardens chiefly round temples.

Helicteres Isora, see Shrubs, Alternate, Stipulate, Simple.

Jatropha curcas, see Shrubs, Alternate, Stipulate, Simple.

Baliospermum axillare, see Shrubs, Alternate, Stipulate, Simple.

Ficus palmata,
Phagwar, dudi.
URTICACEÆ.
F. B. I. v. 530.
The Plains to 5,000 ft.

large, bark smooth, grey ; leaves 3-5 ins. long, round ovate, pointed, toothed, deeply palmately five-lobed, rough above, felted beneath, stalk ½-1 in. long, velvety, stipules soon falling off, ovate, pointed, velvety ; figs ½-1 in. dia., usually solitary, velvety, yellow when ripe, basal bracts 3, pointed, soon falling off, stalk ½-¾ in. long.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

Piptanthus nepalensis,
LEGUMINOSÆ.
F. B I. ii. 62.
Himalaya, 7-9,000 ft.

large, bark green ; leaves of three digitate leaflets, stalk $\frac{3}{4}$-$1\frac{1}{2}$ ins. long, stipules small, united, broadly triangular, velvety, soon falling off, leaflets sessile, 2-4 by $\frac{1}{2}$-1 in., lanceolate, long-pointed ; flowers yellow 1-$1\frac{1}{2}$ ins. long, crowded in hairy racemes 4-5 ins. long, bracts ovate, felted, soon falling off, calyx felted, bell-shaped, two upper teeth broad, three lower narrow, divided nearly to the base, petals all stalked, 1 in. long, stamens 10, ununited ; pod 3-5 by $\frac{1}{4}$-$\frac{1}{2}$ in., flat, stalked, seeds 3-10.

Argyrolobium flaccidum,
LEGUMINOSÆ.
F. B. I. ii. 63.
The Plains to 9,000 ft.

small, covered with densely silky hairs ; leaves of three digitate leaflets, leaf stalk short, stipules minute, linear, leaflets pale, silky, nearly equal, lanceolate shortly pointed, $\frac{1}{2}$-$\frac{3}{4}$ in. long ; flowers small yellow, few in short racemes on stalks longer than the leaves, calyx deeply two-lipped, upper lip two-toothed, lower three-toothed, teeth narrow, petals smooth, hardly longer than the calyx, stamens 10, united ; pod $\frac{3}{4}$-1 in. long, densely silky 6-8 seeded.

Ononis hircina,
LEGUMINOSÆ.
F. B. I. ii. 85.
Himalaya, 5-7,000 ft.

small, velvety stems ; leaves with three pinnate leaflets, leaf stalks short, stipules large, leafy, attached to the leaf stalk, leaflets oblong, blunt, toothed ; flowers reddish in pairs, forming a close terminal leafy raceme, calyx bell-shaped, $\frac{3}{8}$ in. long, teeth linear, longer than the tube, petals stalked, stamens 10, united ; pod oblong, downy, not protruding from the calyx, 2-3 seeded.

Indigofera trita,
LEGUMINOSÆ.
F. B. I. ii. 96.
The Plains.

small, branches many, rigid, widely separating, thinly covered with grey hairs flattened against the stem ; leaves with three leaflets, leaf stalk $\frac{1}{4}$ $\frac{3}{8}$ in. long, stipules minute, bristle-like, leaflets oblong with a broad tip, lateral leaflets nearly sessile, $\frac{1}{2}$-1 in. long, opposite, terminal leaflet, 1-$1\frac{1}{2}$ in. long, stalked ; flowers purplish red, $\frac{1}{2}$ in. long on spike-like racemes, shorter than the leaves, 6-12-flowered, calyx $\frac{1}{12}$ $\frac{1}{8}$ in. long, grey, teeth bristle-like, corolla $\frac{1}{4}$ in long, stamens

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

10, all united, but upper one, anthers with pointed tip ; pod 1-$1\frac{1}{4}$ ins. long, bending down or spreading, very firm, four-angled, without contractions, pointed 8-10 seeded.

Psoralea plicata,
Bakhtmal.
LEGUMINOSÆ.
F. B. I. ii. 103.
The Plains.

small, branches many, stems silvery, warty, branchlets when bare somewhat spinous ; leaves shortly, stalked, leaflets three, $\frac{1}{2}$-1 in. long, terminal leaflet largest, lateral ones oblique, blunt, margin wavy gland-dotted beneath ; flowers yellow in short-stalked racemes, 2-3 ins. long, bracts ovate, very minute, calyx $\frac{1}{8}$ in. covered with white hairs, teeth short, the lowest is the longest, corolla slightly projecting beyond the calyx, stamens 10, all united but the upper one ; pod oblong, clasped by the calyx, one seeded.

Tavernicra nummularia,
LEGUMINOSÆ.
F. B. I. ii. 140.
The Plains.
Rawulpindi.
Kahuta.

small, branches many, slender, finely grey ; leaves shortly stalked, stipules minute, lanceolate, thin and dry, leaflets 3, nearly round, $\frac{1}{4}$-1 in. long, oblong ovate with broad tips ; flowers red, $\frac{1}{2}$ in. long, in racemes longer than the leaves, calyx $\frac{1}{8}$-$\frac{1}{6}$ in., thinly silky, stamens 10, united ; pod roundish, 1-4 seeded. This plant is found on stony ground.

Uraria picta,

see Herbs, Erect, Alternate, Stipulate, Compound.

Uraria lagopus,
LEGUMINOSÆ.
F. B. I. ii. 156.
Himalaya, up to 6,000 ft.
Simla.

medium size, stem and branches from densely velvety to bristly, branches slender ; leaves 5-6 ins. long, stipules lanceolate, long pointed, stalk 2-3 ins. long, leaflets 3, sometimes one, ovate, blunt, tip notched $2\frac{1}{2}$-$4\frac{1}{2}$ ins. long, rough above, pale and felted beneath ; flowers very many, purple, $\frac{1}{4}$-$\frac{1}{3}$ in. long, in terminal and axillary racemes, 6-12 ins. long, bracts hairy, ovate $\frac{1}{3}$ in. long, pointed, calyx $\frac{1}{6}$-$\frac{1}{5}$ in. long, corolla just protruding from the calyx, stamens 10, all united, but the upper one ; pod sessile, two to six jointed, hairy, flattened folded face to face within the calyx.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

Uraria neglecta,
(*of Prain*).
DEGUMINOSÆ.
F. B. I. ii. 156.
Himalaya, 1-3,000 ft.
(Duthie.)

medium size ; slender, velvety, woody branches ; this plant is like *Uraria lagopus* in its flowering parts but differs in its foliage, bracts and pods ; leaves of one leaflet (simple) or three leaflets, stipules long pointed from a broad base, hairy, leaflets, 3-5 ins. long, ovate-oblong, net-veined, entire, blunt-pointed or notched, rarely short-pointed, base rounded, smooth above, velvety beneath, terminal leaflet largest, stalked, lateral nearly sessile, flowers $\frac{1}{4}$-$\frac{1}{3}$ in. purple, many on long, hairy stalks, crowded in cylindrical terminal racemes, 3-6 in. long and about 1 in. broad, bracts overlapping in bud, ovate with a hard sharp point, hairy, soon falling off, calyx $\frac{1}{4}$ in., hairy, teeths, feathered, lower long, stamens and style like the last species ; pod smooth, otherwise like the last species.

Ebenus stellata,
LEGUMINOSÆ.
F. B. I. ii. 140.
Himalaya, 4-8,000 ft.

small, covered with spreading erect thorns 1-$\frac{1}{2}$ in., long ; leaves odd pinnate, shorter than the spines, leaflets 3, lanceolate, $\frac{1}{4}$-$\frac{3}{4}$ in. long, margins even ; flowers red, sessile in crowded heads on axillary stalks, surrounded by lanceolate bracts, calyx $\frac{1}{2}$ in. long covered with long brown silky hairs, teeth bristle-like, feathery, corolla much shorter than the calyx, stamens 10, united except the upper one ; pod flat, oblong, thin, enclosed in the calyx tube, seed one.

Lespedeza sericea,
LEGUMINOSÆ.
F. B. I. ii. 142.
Himalaya, 2-8,000 ft.
Simla (Collett).
Hazara, Kashmir.

small, branches long tough slender, velvety ; leaves directed, obliquely upwards, nearly sessile, crowded, overlapping, leaflets 3, tip notched, $\frac{1}{4}$-$\frac{1}{2}$ in. long, wedge-shaped, usually smooth above, white silky beneath ; flowers $\frac{1}{4}$ in. long, white or yellow tinged with purple in clusters of two to four in the leaf axils all down the branch, stalks short, bracteoles linear, minute, calyx $\frac{1}{12}$-$\frac{1}{8}$ in. with short white hairs, teeth awl-like, very long, corolla $\frac{1}{4}$ in., stamens 10, all united, but the upper one ; pod $\frac{1}{8}$ in., thinly silky, hardly longer than the calyx, one-seeded.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

Lespedeza juncea,
LEGUMINOSÆ
F. B. I. ii. 142.
Kashmir, Simla,
4-8,000 ft.

smaller than the last, but very like it, the leaves less crowded, flowers pale purple.

Lespedeza Gerardiana,
LEGUMINOSÆ.
F. B. I. ii. 142.
Himalaya, 5-10,000 ft.
Simla (Collett).

small, like Lespedeza sericea, but leaflets rather larger, flowers twice as large, pods $\frac{1}{10}$ in. very small, concealed in the calyx.

Lespedeza elegans,
LEGUMINOSÆ.
F. B. I. ii. 143.
Kashmir, 5-6,000 ft.

small, branches slender, finely downy ; leaves absent at the ends of branches, leaf stalk $\frac{1}{2}$-$\frac{3}{4}$ in. long, leaflets $\frac{1}{2}$-$\frac{3}{4}$ in. long, oblong, blunt, smooth above, grey silky beneath; flowers in clusters of 6-8, extending low down the branches and at the top forming leafless branching racemes, calyx $\frac{1}{6}$-$\frac{1}{4}$ in., very velvety, teeth linear awl-like, very long, corolla half as long again as the calyx, stamens 10, all united but the upper one ; pod sessile, $\frac{1}{6}$ in. long, oblong, downy, one-seeded.

Lespedeza macrostyla,
LEGUMINOSÆ.
F. B. I. ii. 143.
Himalaya, 2-6,000 ft.
Sutlej and Giri Valleys.
(Collett).
Synj.

small, but larger than the four preceding species, branches woody, densely velvety ; leaves shortly stalked, leaflets 3, ovate with a broad tip, $\frac{1}{2}$ in. long and nearly as broad, nearly smooth above, densely white silky below ; flowers $\frac{1}{2}$ in. long, deep red, clustered in racemes $\frac{1}{2}$ in. long, bracts silky, ovate concealing the buds, calyx $\frac{1}{8}$ in., white silky, teeth lanceolate, corolla $\frac{3}{8}$ in. long, stamens 10, all united but the upper one ; pod shortly stalked, $\frac{3}{8}$-$\frac{1}{2}$ in. long, narrow to both ends, point $\frac{1}{2}$ in. long, lower half feathery, one-seeded.

Lespedeza eriocarpa,
LEGUMINOSÆ.
F. B. I. ii. 144.
Himalaya, 3-9,000 ft.
Simla, Mashobra,
Matiana, Shali (Collett).

as large as the last species. branches many, branchlets grooved, slender, angular, silky; leaves with stalks, $\frac{1}{2}$-1$\frac{1}{2}$ in. long, leaflets 3, ovate, wedge-shaped with a broad tip, $\frac{1}{2}$-1 in. long, stiff somewhat leathery, smooth above, velvety pale below ; flowers $\frac{1}{2}$ in. long, deep red-purple in racemes 2-4 ins. long, bracts not

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

longer than the buds, calyx $\frac{1}{8}$ in., silky, broad, teeth linear awl-like, corolla $\frac{3}{8}$-$\frac{1}{2}$ in. long, stamens 10, all united but the upper one ; pod ovate, $\frac{1}{4}$ in. long, hairy, point as long as the pod, velvety at the base, one-seeded.

Desmodium laxflorum,
LEGUMINOSÆ.
F. B. I. ii. 164.
Himalaya, up to 6,000 ft.
Kangra (Duthie).

medium size, branches somewhat angled covered with short hairs, leaf stalk 1-2 ins., stipules lanceolate long-pointed, leaflets 3, ovate, pointed, 4-6 ins. long sometimes broad at the tip and blunt, thin or almost leathery, smooth above, flattened hairs beneath, stipels awl-like ; flowers small, white, tinged with blue, many in axillary and terminal racemes, the terminal often 12 ins. long, bracts minute linear awl-like, calyx $\frac{1}{14}$ in. long, hairy, teeth lanceolate longer than the tube, stamens 10, all united but the upper one ; pod 1-1$\frac{1}{2}$ ins. long, covered with minute hooked hairs, slightly contracted at the joints, 6-10 joints, flattened joints easily breaking and catching on to clothes by the hooked hairs.

Desmodium podocarpum,
LEGUMINOSÆ.
F. B. I. ii. 165.
Himalaya, 2,000 to 7,000 ft.
Simla (Collett).

small, branches velvety, angular ; leaves 3-6 ins. long, stalk 1-3 ins. long, stipules small, bristle-like leaflets 3, thin, 2-3 ins. long, both surfaces nearly smooth, lower pale ovate with a broad tip, pointed, end leaflet roundish, somewhat pointed, with a triangular base ; flowers pink, $\frac{1}{8}$ in. long, in drooping racemes few flowered, terminal racemes 12 ins. long, much branched, bracts minute linear, calyx $\frac{1}{24}$ in. long, teeth triangular, very short, corolla $\frac{1}{8}$ in., stamens 10, all united but the upper one ; pod $\frac{1}{2}$ in. long with 1-2 joints, joint $\frac{1}{4}$ in. long, upper margin of pod straight, lower deeply indented.

Desmodium floribundum,
LEGUMINOSÆ.
F. B. I. ii. 167.
Himalaya, up to 7,000 ft.
Simla (Collett).

large, stem hairy, branches angular, densely velvety; leaves 4-6 ins. long, stipules lanceolate, $\frac{1}{2}$ in. long leaflets 3, somewhat leathery, 2-4 ins. long, end one largest, ovate, blunt or pointed, both surfaces hairy, lower pale ; flowers many, pink purple, $\frac{1}{2}$ in. long, in axillary and terminal racemes 3-6 ins. long, often with

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

the flowers directed to one side only, bracts long-pointed, $\frac{1}{4}$ in. long, fringed with hairs, calyx $\frac{1}{8}$ in. long, corolla $\frac{3}{8}$-$\frac{1}{2}$ in. long ; pod sessile, very hairy, $\frac{3}{4}$-1 by $\frac{1}{8}$ in., upper margin slightly, lower deeply indented, joints 6-8 longer than broad.

Desmodium oxyphyllum,
LEGUMINOSÆ.
F. B. I. ii. 168.
Himalaya, up to 7,000 ft.
Simla (Baker).

medium size ; branches slender, smooth, cylindrical, leaves 3-5$\frac{1}{2}$ ins. long, stalk 1-1$\frac{1}{2}$ ins. long, leaflets 3, pointed, thin or somewhat leathery, smooth above, pale grey silky beneath, end one ovate oblong with tip broad, gradually narrowed to a point, 2-4 ins. long ; flowers many, $\frac{1}{2}$ in. long, in short axillary, or terminal branching racemes, bracts lanceolate, long pointed, fringed with hairs, $\frac{1}{4}$ in. long, calyx 1$\frac{1}{2}$ in. nearly smooth, teeth very short, corolla $\frac{3}{8}$-$\frac{1}{2}$ in. long, stamens 10, all united, but the upper one ; pod 2-3 ins. long, $\frac{1}{4}$ in. broad, shortly stalked, joints longer than broad, 6-8.

Desmodium tiliaefolium,
Chamra, pirhi kalimort.
LEGUMINOSÆ.
F. B. I. ii. 168.
Himalaya, up to 9,000 ft.
Simla, Mashobra (Collett.)
Murree (Douie).

medium size ; branches spreading, branchlets velvety ; leaves 4-6 ins. long, leaflets 3, broadly ovate 2-4 ins. long, rather leathery, end one longest, silky beneath ; flowers pink, $\frac{3}{4}$ in. long, in numerous branching racemes, up to 12 ins. long, calyx $\frac{1}{8}$ in. downy, teeth triangular, shorter than the tube, corolla $\frac{3}{8}$-$\frac{1}{2}$ in., stamens 10, all united, but the upper one ; pod sessile, broad, 2-3 ins. long, joints 6-9, longer than broad, upper margin slightly, lower deeply indented.

Desmodium sequax,
LEGUMINOSÆ.
F. B. I. ii. 170.
Himalaya, 4-7,000 ft.
Simla (Collett).

large, branches with dense grey velvet when young ; leaves 4-7 ins. long, leaflets 3, ovate-lanceolate or lanceolate, gradually pointed, hairy above, more densely below, end leaflet 2$\frac{1}{2}$-4 by 5$\frac{1}{2}$-2$\frac{1}{2}$ ins. ; flowers pink, $\frac{1}{4}$ in. long on lateral and terminal branching racemes, calyx $\frac{1}{12}$ in., teeth lanceolate, stamens 10, all united but the upper one; pod sessile $\frac{1}{2}$-$\frac{3}{4}$ in. long, $\frac{1}{12}$ in. broad, 6-8 jointed, woolly with minute hooked hairs, upper margin slightly, lower deeply indented.

Shrubs with Alternate Stipulate Compound Leaves.

Pod Bearing Plants.

Petals Dissimilar, Upper one Largest.

Leaflets Three.

Desmodium concinnum, Leguminosæ. F. B. I. ii. 170. Himalaya, 1-7,000 ft. Simla (Collett).	large, branches drooping, velvety; leaves $2\frac{1}{4}$-4 ins. long, leaflets 3, green smooth above, grey hairy beneath, end leaflet 2-3 ins. long, longest; flowers dark blue $\frac{1}{4}$ in. long, in lateral and terminal racemes, calyx $\frac{1}{12}$ in., corolla $\frac{1}{4}$-$\frac{1}{3}$ in., stamens 10, all united but the upper one; pod $\frac{3}{4}$-1 in. long, $\frac{1}{8}$ in. broad, shortly stalked, curved, 4-6 jointed, downy, upper margin wavy, lower deeply notched, upper margin of each joint hollowed out.
Desmodium polycarpum, Leguminosæ. F. B. I. ii. 171. The Plains to 5,500 ft. Valleys below Simla (Collett).	small, branches angular, slender, hairy; leaves $1\frac{1}{2}$-4 ins. long, leaflets 3, broadly ovate, nearly smooth above, hairy paler beneath, end leaflet 1-2 by $\frac{1}{2}$-1 in., blunt; flowers purple, or white, $\frac{1}{4}$ in. long, racemes terminal or lateral, short stalked 1-3 ins. long, calyx $\frac{1}{12}$ in., teeth long pointed, corolla less than $\frac{1}{4}$ in., stamens 10, all united, but the upper one; pod $\frac{1}{2}$-$\frac{3}{4}$ in. long, $\frac{1}{3}$ in. broad, 5-8 jointed, straight, hairy, upper margin straight, lower slightly notched.
Desmodium gyrans, The Telegraph or Semaphore Plant, Leguminosæ. F. B. I. ii. 174. Himalaya, to 7,000 ft. Valleys below Simla (Collett).	small, branches nearly cylindric, smooth; leaves $3\frac{1}{2}$-$4\frac{1}{2}$ ins. long, leaflets 3, oblong lanceolate, blunt, end one 2-4 by $\frac{3}{4}$-1 in., lateral leaflets often one or both wanting, $\frac{1}{2}$ in. long, moving by jerks, especially in sunlight; flowers $\frac{1}{2}$ in. long, pale yellow, in axillary or terminal racemes, 3-6 ins. long, buds in pairs, enclosed in the bracts, calyx $\frac{1}{12}$ in., teeth triangular, corolla $\frac{1}{4}$ in., side petals tinged with pink or blue, stamens 10, all united but the upper one; pod sessile, 1-$1\frac{1}{2}$ by $\frac{1}{6}$-$\frac{1}{5}$ in., curved like a sickle, 6-10 jointed, upper margin even, lower slightly notched.
Cajanus indicus, Pigeon pea, *Arhar dal.* Leguminosæ F. B. I. ii. 217. The Plains to 6,000 ft.	medium size, much cultivated as a food grain; branches many, grooved, silky; stipules minute, lanceolate, leaflets 3, oblong lanceolate, pointed, densely silky beneath; flowers yellow, streaked with red veins $\frac{3}{4}$ in. long, in branching axillary or terminal racemes, calyx $\frac{1}{4}$ in., corolla $\frac{3}{4}$ in., stamens 10, all united but the upper one; pod 2-3 ins. long, finely downy, often marked with reddish purple streaks, seeds 3-5, the size of a small pea, yellow and red to brown or black.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS THREE.

Ryhnchosia Pseudo-cajan,
LEGUMINOSÆ,
F. B. I. ii. 223.
Himalaya, 3-9,000 ft.
Sutlej Valley (Collett).
Hazara, Murree.

medium size, branches slender twiggy, white-felted longitudinally ribbed, leaves 1-3 by 1-4 ins., grey green, velvety above, white woolly beneath, leaflets 3, $\frac{1}{2}$-2 by $\frac{1}{4}$-1$\frac{1}{2}$ ins., lateral sessile, terminal stalked, largest, oblong, apex triangular, stipules minute, soon falling off ; flowers yellow, $\frac{1}{2}$ in. long, in short-stalked close axillary clusters, calyx $\frac{3}{8}$ in., 5-toothed, lowest tooth longest, linear, bristly, all densely woolly, corolla $\frac{1}{2}$-$\frac{5}{8}$ in., stamens 10 all united but one, the uppermost ; pod 1 by $\frac{3}{8}$ in., straight, flattened, grey-woolly, 1-2 seeded.

Indigofera tinctoria, The Indigo Plant,
Nil.
LEGUMINOSÆ,
F. B. I. ii. 99.
The Plains.

medium size, cultivated, branches twiggy, tough, angular, thinly covered with silvery hairs, flatttened against the stem ; leaves 2-3 ins. long with a stalk $\frac{1}{2}$-1 in. long, stipules minute, awl-like, leaflets 7-13, shortly stalked, $\frac{3}{4}$-1 in. long, ovate-oblong, or nearly circular, bluish-green above, silvery beneath, stipels minute, bristle, like ; flowers reddish-yellow, very small on stalked, erect,spikle, like racemes, many-flowered, shorter than the leaves, bracts awl-shaped. calyx $\frac{1}{24}$ in., silvery, teeth equal to the tube, corolla longer than the calyx, stamens 10, all united but the upper one, anthers with pointed tip ; pod 1-1$\frac{1}{2}$ ins. long, $\frac{1}{12}$ in. thick, nearly smooth, 8-12 seeded, without contractions. This plant yields the indigo of commerce.

Indigofera Gerardiana,
Kenthi
LEGUMINOSÆ.
F. B. I. ii. 100.
Salt Range and Himalaya, 2-10,000 ft.
Simla (Collett).
Hazara, (Barrett).

medium size, branches many, branchlets silvery with hairs flattened against the stem ; leaves 1$\frac{1}{2}$-3 ins. long, shortly stalked, leaflets 17-31, opposite, $\frac{1}{4}$-$\frac{1}{2}$ in. long, ovate with a broad tip, pale grey beneath, short white hairs above, stipels minute ; flowers $\frac{1}{4}$-$\frac{1}{2}$ in. long, pale red or purple, on racemes 2-4 ins. long, stalked, 12-20 flowered, calyx obliquely bell-shaped, silvery hairy, $\frac{1}{12}$ in. long, corolla silvery outside, stamens 10, all united but the upper one, anthers with pointed tip ; pod 1$\frac{1}{2}$-2 ins. long, nearly cylindrical, smooth, 6-10 seeded.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING PLANTS.

PETALS DISSIMILAR, UPPER ONE LARGEST.

LEAFLETS MANY.

Indigofera atropurpurea,
LEGUMINOSÆ.
F. B. I. ii. 101.
Himalaya to 9,000 ft.
Sutlej Valley near Rampur (Collett).

large, branchlets nearly smooth ; leaves 6-9 ins. long, stalk 1-3 ins. long, leaflets 1-1$\frac{1}{2}$ ins. long, 5-13 opposite, blunt, green above, pale green below, stipels minute, flowers dark red purple, $\frac{1}{4}$-$\frac{1}{3}$ in. long, on shortly stalked racemes, 4-8 ins. long, bracts $\frac{1}{8}$ in. long pointed, longer than the buds, calyx $\frac{1}{10}$ in. long, teeth short, triangular, corolla $\frac{1}{4}$-$\frac{1}{3}$ in. long, stamens 10, all united but the upper one, anthers with pointed tip ; pod 1-1$\frac{1}{2}$ ins. long, linear, smooth, 6-10 seeded.

Indigofera hebepetala,
LEGUMINOSÆ.
F. B. I. ii. 101.
Himalaya, 6-15,000 ft.
Mahasu, Theog, Narkanda (Collett).

large, branchlets nearly smooth ; leaves 4-6 ins. long, leaflets opposite, 13-17, 1-1$\frac{1}{2}$ ins. long, ovate, blunt, a few flattened hairs on both surfaces, stipels distinct ; flowers crimson red, $\frac{1}{3}$ in. long, in stalked loosely 12-20-flowered racemes, bracts boat-shaped, bristle-pointed, longer than the buds and enclosing them, corolla $\frac{3}{8}$ in. long, stamens 10, all united but the upper one, anthers with pointed tip ; pod smooth, straight, 1$\frac{1}{2}$-2 ins. long, 8-10 seeded.

Indigofera pulchella,
LEGUMINOSÆ,
F. B. I. ii. 101.
Himalaya to 5,000 ft.
Valley below Simla (Collett).
Hazara (Barrett).

medium size, trunk thick ; leaves 3-6 ins. long, shortly stalked, leaflets 11-19, opposite $\frac{3}{4}$-1 in. long, ovate-oblong, broad at the tip, blunt, often notched, pale green above, greenish blue beneath, thinly covered with flattened grey hairs, stipels very minute or none ; flowers bright pink fading to violet, $\frac{1}{3}$ in. long, in shortly stalked racemes 1-4 ins. long, bracts boat-shaped with a long point, longer than the buds, calyx $\frac{1}{12}$ in. long, silvery, teeth short triangular, corolla $\frac{3}{8}$-1 in., bright red, stamens 10, all united but the upper one, anthers with pointed tip ; pod 1$\frac{1}{4}$-1$\frac{3}{4}$ ins. long, smooth, straight, 8-12 seeded.

Indigofera Dosua,
LEGUMINOSÆ.
F. B. I. ii. 102.
Himalaya, 6-8,000 ft.
Simla Mashobra (Collett).

small, hairy or velvety ; leaves 1-3 ins. long, nearly sessile, leaflets 19-35, opposite, linear-oblong, $\frac{1}{4}$-$\frac{1}{3}$ in., hairy, pale below, stipels none ; flowers $\frac{1}{2}$ in. long, bright red in stalked racemes, 1-3 ins. long, bracts $\frac{1}{4}$ in. long, silky, pointed, longer than the buds, calyx $\frac{1}{12}$ in. long, silky, teeth triangular hard point, corolla $\frac{3}{8}$-$\frac{1}{2}$ in., stamens 10, all united but upper one, anthers with pointed tip ; pod 1-1$\frac{1}{4}$ ins. long, straight, nearly smooth, 8-12 seeded.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS DISSIMILAR.

Colutea arborescens, Bladder senna, LEGUMINOSÆ. F. B. I. ii 103. Himalaya, 8-11,000 ft. Simla, Mahasu, Matiana (Collett).	medium size, nearly smooth ; leaves 2-6 ins. long leaflets 9-13, ovate with a broad tip, $\frac{1}{4}$-$\frac{1}{2}$ in., pale green, often with a notched tip ; flowers yellow with a tinge of red, $\frac{3}{4}$ in. long, in three to four flowered racemes equal to the leaves in length, calyx bell-shaped, teeth 5, short, the lowest is longest, stamens 10. all united but the upper one ; pod $\frac{1}{2}$-2 ins. long, inflated ovoid, seeds many, kidney-shaped. The leaves are mildly purgative.
Sesbania ægyptiaca, *Jaint, jait.* LEGUMINOSÆ. F. B. I. ii. 114. The Plains to 4,000 ft.	large, soft-wooded ; leaves 3-6 ins. long, leaflets 21-41, smooth, linear oblong, pale green, very shortly stalked ; flowers pale yellow, tinged with purple, $\frac{1}{2}$-$\frac{3}{4}$ in. long, in axillary few-flowered racemes, 3-6 ins long, calyx $\frac{1}{6}$ in., smooth, teeth short, triangular. stamens 10, all united but the upper one ; pod 6-9 ins. long, beaded, flexible, twisted, 20-30-seeded, divisions between the seeds. The seeds are used as an astringent in Mahomedan medicine.
Sebsania aculeata,	see Herbs, Erect, Alternate, Stipulate, Compound.
Caragana brevispina, *Bakrati.* LEGUMINOSÆ. F. B. I. ii. 116. Himalaya, 5-9,000 ft. Matiana, Narkanda (Collett). Kashmir, Kagan Valley (Douie).	large, spinous, hairy, branchlets finely downy, old leaf stalks persistent, 2-4 ins , spine-tipped ; leaves even-pinnate, 2-3 ins., clustered on short thick branchlets, stipules spinous, leaflets 8-16, opposite. ovate, $\frac{1}{4}$-1 in., upper surface smooth, lower silky, pale ; flowers bright yellow, 1 in. long, in stalked few flowered clusters, shorter than the leaves, calyx velvety, oblique, tubular, teeth fine, spine-tipped. stamens 10, all united but the upper one ; pod flattened, velvety, 2-3 ins. long, straight, cylindrical. woolly within, seeds 3-4. This plant is used for fattening goats.
Tephrosia purpurea,	see Herbs, Erect, Alternate, Stipulate, Compound.
Tephrosia villosa,	see Herbs, Erect, Alternate, Stipulate, Compound.
Astragalus Falconeri,	see Herbs, Erect, Alternate, Stipulate, Compound.
Astragalus Trichocarpus,	see Herbs, Erect, Alternate, Stipulate, Compound.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS DISSIMILAR.

Astragalus chlorostachys,
LEGUMINOSÆ.
F. B. I. ii. 128.
Himalaya, 5-14,000 ft.
Simla Mahasu (Collett).

small, many slender branches, covered with short hairs; leaves 3-6 ins. long, stipules small, lanceolate, spreading, leaflets 13-17, oblong, ½-¾ in. long, blunt, waxy greenish blue above, white silky beneath; flowers many, ½-¾ in. long, yellow green tinged with lilac, crowded in erect racemes 3-6 ins. long, bracts lanceolate; hardly longer than the buds, calyx velvety, half the length of the corolla, teeth very short, stamens 10, united all but the upper one; pod smooth, oblong, pointed, ½ in. long, narrowed into a stalk ½ in. long, seeds 6-10.

Astragalus Stewartii,
LEGUMINOSÆ.
F. B. I. ii. 129.
Hazara, 5-9000 ft.

like the last, but the leaves densely white silky, the bracts and calyx teeth with long bristles, the latter protruding beyond the buds, pods completely two-celled, seeds 6-10.

Astragalus longicaulis,
LEGUMINOSÆ.
F. B. I. ii. 129.
Kashmir.

like the last, but leaflets 21-25, narrow-oblong; pod 10-12 seeded.

Astragalus graveolens,
LEGUMINOSÆ.
F. B. I. ii. 131.
Himalaya, 4-12,000 ft.
Hazara (Douie).
Murree.

small, branches; many, rodlike, rounded leaves 4-6 ins. long, stipules leafy, 1-1½ ins. long, leaflets 17-19 round-oblong. opposite, firm, blunt, smooth on both surfaces, ½-1 in. long; flowers yellow ¾ in. long on long stalked racemes 6-12 ins. long. bracts linear, smooth, calyx tubular, smooth, ⅜ in. long, teeth half the tube's length, stamens 10, all united but the upper one; pod 1-1¼ ins. long, ¼ in. broad, smooth, stalked, two-celled, 12-18 seeded.

Astragalus candolleanus,
LEGUMINOSÆ.
F. B. I. ii. 132.
Himalaya, 8-13,000 ft.

small, stems woody, a few inches long, below the tufts of leaves with many woody leaf stalks of old leaves with lanceolate membraneous stipules; leaves 3-4 ins. long, leaf stalks 1-2 ins., finely dawny, leaflets 17-25, oblong, blunt, bluish waxy green, ¼-½ in. long, more or less silky; flowers 1½ ins. long, yellow in nearly sessile heads, many, bracts linear, calyx ½ in. long, densely silky, teeth linear, stamens 10, all united but the upper one; pod ¾-1 in. long, curved, shortly stalk-

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS DISSIMILAR.

ed, firm, two-celled, narrowed to both ends, 12-16 seeded.

Astragalus pyrrhotrichus,
LEGUMINOSÆ.
F. B. I. ii. 133.
Hazara, 1-6,000 ft.

small, stem short woody, covered with long fine brown hairs, no old leaf stalks as in the last; leaves 6-12 ins. long, stipules ½-¾ in. long, lanceolate, silky, leaflets 41-51, roundish, ¼-⅜ in. long, blunt with a fine point, covered with long silky hairs; flowers 1½ ins. long, yellow, in close 6-12-flowered 1-4 ins. stalked heads, bracts linear bristle-like, feathery, calyx very silky, ¾-⅞ in. long, teeth bristle-like, nearly as long as the tube, stamens 10, all united but the upper one; pod nearly sessile, oblong-halved, silky, two-celled, 10-12 seeded.

Astragalus Malacophyllus,
LEGUMINOSÆ
F. B. I. ii. 133.
Himalaya, 8-11,000 ft.

small, stem a foot long, densely velvety; leaves 2-4 ins. long, stipules lanceolate ⅜-½ in. long, leaflets 31-41, densely silky, oblong, blunt, ¼-½ in. long; flowers 1½ ins. long, yellow in shortly stalked close heads, bracts linear bristle-like, calyx ½ in. long, densely silky, teeth linear, stamens 10, all united but the upper one; pod ½ in. long, sessile, two-celled, silky, 8-10 seeded.

Astragalus polyacanthus,
LEGUMINOSÆ.
F. B. I. ii. 134.
The Plains to 12,000 ft.
Rawalpindi.
Hazara (Douie).
Murree.

small, branchlets short, armed with the old leaf stalks 1½-2 ins. long; leaves 1½-3 ins. long, stipules triangular, leaflets 9-13, oblong, slightly silky, pale bluish green, ¼-½ in. long; flowers yellow, usually in twos, sessile in the axils of leaves, 1¼ ins. long, calyx tubular, ½ in. long, silky, teeth short, linear, stamens 10, all united but the upper one; pod ½ in. long, oblong-halved, sessile, two-celled, seeds 15-20.

Astragalus cicerifolius,
LEGUMINOSÆ.
F. B. I. ii 134.
Himalaya, 10-17,000 ft.

small, densely armed with the old leaf stalks, 3-6 ins. long; leaves 3-6 ins. long, stipules lanceolate, leaflets, ¼-⅜ in. long, 31-41, blunt, lanceolate with a broad tip, pale green, soon falling off; flowers 3-4 on shortly stalked heads in the axils of leaves, yellow, 1½ ins. long, calyx ½ in. long, with a few black or brown hairs, teeth bristle-like, stamens 10, all united but the upper one; pod ½-¾ in. long, oblong, densely silky, two-celled, narrowed to the point, seeds 15-20.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS DISSIMILAR.

Astragalus multiceps, *Kandiara, sarmul.* LEGUMINOSÆ. F. B. I. ii. 134. Himalaya, 8-12,000 ft.	small, main stem very short, branchlets with tufts of leaves very close together, armed with the old leaf stalks $1\frac{1}{2}$ 3 ins. long, leaves $1\frac{1}{2}$-3 ins. long, stipules $\frac{1}{4}$ in. long, lanceolate, leaflets 21-31, oblong-ovate with broad tip, $\frac{1}{12}$-$\frac{1}{6}$ in. long, covered with grey silky hairs ; flowers one or two together in leaf axils, sessile or nearly so, yellow, 1 in. long, bracts linear, $\frac{1}{8}$ in. long, calyx $\frac{1}{4}$ in. long, silky, teeth linear bristle-like, stamens 10, all united but the upper one ; pod sessile, oblong, $\frac{1}{2}$ in. long, covered with fine grey silky hairs, seeds 12-14.
Astragalus zanskarensis, LEGUMINOSÆ. F. B. I. ii. 134. Himalaya, 10-14,000 ft.	small, main stem short, branchlets with closely crowded leaves. lower parts armed with the old leaf stalks 3-4 ins. long ; leaves 3-4 ins. long, stipules $\frac{1}{2}$ in; long, lanceolate, leaflets 21-25, oblong, blunt, soon falling off, $\frac{1}{4}$-$\frac{3}{8}$ in. long, densely brown silky velvet flowers yellow, $1\frac{1}{4}$ ins. long, in few to six flowered shortly stalked heads, bracts linear bristle-like, feathery. calyx $\frac{1}{2}$-$\frac{5}{8}$ in. long, tubular, densely silky, teeth bristle-like, stamens 10, all united but the upper one ; pod shortly stalked, seeds up to 20.
Astragalus leptocentrus, LEGUMINOSÆ. F. B. I. ii. 135. Himalaya, 14,000 ft.	small, main stem lengthened, armed with the old leaf stalks, 2-3 ins. long, velvety. branches velvety, branchlets with closely clustered leaves, leaflets 21-31, oblong blunt, $\frac{1}{8}$-$\frac{3}{8}$ in. long, grey brown, silky velvet on both surfaces ; flowers yellow, $1\frac{1}{4}$ in. long. one or two together without a stalk common to both, in the leaf axils, calyx $\frac{1}{2}$ in. long. densely silky, teeth linear, bristle-like, stamens 10, all united but the upper one ; pod oblong, $\frac{1}{2}$-$\frac{5}{8}$ in. long, sessile silky, two-celled, 12-14-seeded.
Astragalus bicuspis, LEGUMINOSÆ. F. B. I. ii. 135. Hazara.	small generally like *A. polyacanthus* above, branches densely silky. stem lengthened. armed with the old leaf stalks 1-2 ins long, leaflets 13-17, oblong, blunt, $\frac{1}{4}$-$\frac{3}{8}$ in. long, shaggy stipules $\frac{1}{4}$-$\frac{3}{8}$ in. long, lanceolate sharp-pointed ; flowers yellow, 1 in. long, one to three together, not on a common stalk, in the leaf axils, calyx $\frac{1}{2}$ in. long, shaggy, stamens 10, all united

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS DISSIMILAR.

but the upper one ; pod shaggy, nearly sessile, oblong, two-celled, $\frac{3}{8}$-$\frac{1}{2}$ in. long, seeds 8-10.

Astragalus strobiliferus,
LEGUMINOSÆ.
F. B. I. ii. 135.
Himalaya, 8-13,000 ft.

very small, branches many, armed with the old leaf stalks, 1-2 ins. long ; leaflets 11-13, lanceolate with a broad tip, short-pointed, $\frac{1}{4}$-$\frac{3}{8}$ in. long, hairy, stipules thin, triangular ; flowers yellow, $\frac{3}{8}$ in. long, sessile in the leaf axils, scarcely showing above the stipules, calyx $\frac{1}{4}$ in. long, thick white velvety, corolla scarcely showing beyond the calyx lobes, withering in situ, stamens 10, all united but the upper one ; pod sessile, silky, seeds 3-4.

Sophora Moorcroftiana,
LEGUMINOSÆ,
F. B. I. ii. 249.
Kashmir.

small, branches many, densely grey downy, armed with the spinous persistent stipules ; leaves 1$\frac{1}{2}$-2 ins. long, leaflets 11-17, soon falling off, broad ovate, blunt with a bristle-like point, $\frac{1}{4}$-$\frac{1}{2}$ in. long, rather leathery, pale green, silky on both surfaces ; flowers yellow, $\frac{1}{2}$ in. long in axillary racemes, calyx $\frac{1}{4}$ in. densely grey silky, teeth short, corolla $\frac{1}{2}$ in., stamens 10, ununited ; pod 3-4 ins. long, 5-6-seeded, velvety.

Sophora mollis,
Himalayan Laburnum,
Kùn, mâlan, Kathi.
LEGUMINOSÆ.
F. B. I. ii. 251.
Salt Range, Hazara, Himalaya, to 6,000 ft.
Choa Saidan Shah (Donie).

small, branches finely grey downy ; leaves often appearing after the flowers are in bloom, pale green, 5-10 ins. long, leaflets 21-41, ovate, $\frac{1}{2}$-$\frac{3}{4}$ in. long, nearly sessile, finely grey downy, leaflets often altered into long curling processes ; flowers yellow, $\frac{3}{4}$ in. long, in axillary racemes 2-3 ins. long, calyx tubular, $\frac{1}{4}$ in. long, teeth, short, blunt, two upper united, stamens 10, all free ; pod stalked, smooth, 3-4 ins. long, 4-6 one-seeded 4-winged joints, often separated by linear constrictions, nearly 1 in. long. This plant is poisonous to all cattle, but goats.

PETALS SIMILAR.

Cassia occidentalis,
Coffee Senna,
Kasunda.
LEGUMINOSÆ.
F. B. I. ii 262.
The Plains, Gurgaon.

medium size, often annual, nearly smooth, spreading ; leaves 6 ins. long, with a bluish waxy gloss, stalk with a single gland at the base, leaflets 3-5 pairs, 1-3 ins. long, opposite, shortly stalked, ovate-oblong, or lanceolate, long pointed, offensive, when crushed : flowers $\frac{1}{2}$ in., yellow, veined with orange, in axillary

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS SIMILAR.

shortly stalked clusters, forming branching terminal racemes, bracts $\frac{1}{2}$ in. long, ovate, long pointed, white tinged with pink, soon falling off, calyx 5-fid to the base, lobes blunt, petals 5, broad, nearly equal stamens 10, 3 upper without anthers, 2 lateral pairs with small anthers, 3 lower longer and with larger anthers, anthers brown, style incurved , pod 4-5 by $\frac{1}{3}$ in., curved, cylindrical with slight contractions, flattened, seeds 15-30, pale brown. A common weed originally introduced from America, the seeds are used by negroes as a substitute for coffee.

Cassia Sophera,
Kasunda.
LEGUMINOSÆ.
F. B. I. ii. 262.
The Plains.

like the last species, but larger with larger leaves and more leaflets, petals scarcely veined, pods not flattened, nor cylindrical with slight contractions, seeds dark brown.

Cæsalpinia pulcherrima,

see Trees, Alternate, Stipulate, Compound.

FLOWERS IN SPIKES OR HEADS.

Dichrostachys cinerca,
Vertuli.
LEGUMINOSÆ.
F. B. I. ii. 288.
Delhi (Duthie).

large ; branches rigid thorny, branchlets many, velvety terminating in spines ; leaves bipinnate, 1-2 ins. long, pinnæ 16-20, stalked-glands at the base of each pair, leaflets 24-30, minute, strap-shaped, sessile, leathery $\frac{1}{12}$-$\frac{1}{8}$ in. long ; flowers minute, yellow on spikes, shortly stalked, axillary, flowers at the base of the spike with white, red or purple staminodes, $\frac{1}{2}$ in. long ; pod 2-3 by $\frac{1}{4}$-$\frac{3}{8}$ in., 6-10-seeded, dry, smooth.

Mimosa rubicaulis,
Shiah kanta, ral.
LEGUMINOSÆ.
F. B. I. ii. 291.
The Plains to 4,000 ft.
Valleys below Simla (Collett).
Rawalpindi.
Valleys below Murree.

large, branches reddish when young, straggling slender, grooved, grey downy, armed with many small, hooked spines ; leaves bipinnate, 6-9 ins., midrib prickly, stipules awl-shaped, pinnæ 8-12, 1-2 ins. long, bristle-like gland between each pair, leaflets 20-24, $\frac{1}{4}$ in. long, linear-oblong 'with a recurved rigid point ; flowers minute, reddish, turning to white in heads, $\frac{3}{8}$-$\frac{1}{2}$ in. broad, on short stalks in the axils of

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

POD BEARING, LEAFLETS MANY.

PETALS SIMILAR.

leaves at the top of the branchlets, corolla $\frac{1}{24}$ in., stamens ununited, 8, $\frac{1}{8}$ in. long; pod curved, 3-4 by $\frac{1}{2}$ in., 6-10 seeded, joints square separating from the sutures.

Mimosa hamata,
LEGUMINOSÆ.
F. B. I. ii. 291.
The Plains.

like the last, but pinnæ fewer and the sutures of the pods armed with large hooked prickles.

NOT POD BEARING PLANTS.

Leea aspera,
Kumála.
VITACEÆ.
F. B. I. i. 665.
The Plains to 7,000 ft.
Simla (Collett).
Kashmir.

large, robust, branches grooved, spreading; leaves large, lower bipinnate, upper pinnate or the lower pinnæ 3-lobed, leaflets 3-6 ins. long, heart-shaped at the base, oblong, sides not parallel, long-pointed, both surfaces rough, round-toothed, stipules sheathing; flowers yellow-green, small in spreading leaf-opposed, nearly smooth clusters, calyx 5-toothed, petals 5, oblong, united and to the staminal tube, stamens 5, united below into a 5-lobed tube, style short; berry $\frac{1}{3}$ in. diam., nearly round, flattened at the top, 3-6-celled and-seeded, black, succulent, edible, seeds wedged-shaped.

Spiræa vestita,

see Herbs, Erect, Alternate, Stipulate, Lobed.

Spiræa Aruncus

see Herbs, Erect, Alternate, Stipulate, Compound.

Spiræa sorbifolia,
ROSACEÆ.
F. B. I. ii. 324.
Himalaya 7-10,000 ft.
Simla (Collett).
Hazara (Barrett.)

large; branches smooth except at first, when rather hairy; leaves even rarely odd pinnate, 8-12 ins. long, stipules linear awl-shaped, leaflets 12-18 or 13-19, narrowly lanceolate, 2-4 ins., sharply toothed, long pointed, end one, if present, may be lobed; flowers white, $\frac{1}{4}$ in. diam., in terminal branching racemes, 6-12 ins. long, calyx cup-shaped, 5 lobed, petals 5, rounded stamens about 20, rarely united at the base, carpels 5, smooth or velvety.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

NOT POD BEARING PLANTS.

PETALS SIMILAR.

Rubus niveus, ROSACEÆ. F. B. I. ii. 335. Himalaya, 6-10,000 ft. Kashmir.	large, stem stout, branches rambling, often purple without bristles on gland tipped-hairs, young often quite smooth or felted, prickles short scattered, pale; leaves pinnately compound, leaflets 3, rarely 5, 1-5 ins. long, entire or lobulate, toothed, short or long pointed smooth above, white felted beneath, terminal leaflet sometimes cordate, leaf stalk 1-2 ins., slender with 1-2 prickles, stipules thread-like ; flowers $\frac{1}{4}$-1 in. diam. pink, axillary or in few-flowered clusters on a long stalk, nodding, bracts thread-like, calyx 5-lobed, persistent, lobes $\frac{1}{4}$-$\frac{1}{3}$ in. long, ovate-lanceolate, velvety, spreading or reflexed in fruit, petals 5, $\frac{1}{5}$-$\frac{1}{4}$ in. diam., broad-ovate, much smaller than the calyx, lobes erect, concealing the stamens, stamens very many, fruit round, large or small, of few or many, dry or fleshy drupes, acid, stones pitted.
Rubus macilentus,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus ellipticus,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus fruticosus,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus antennifer,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus purpureus,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus pungens,	see Prostrate Shrubs, Alternate, Stipulate, Compound.
Rubus biflorus, *Akhreri, dher.* ROSACEÆ. F. B. I. ii. 338. Himalaya, 7-9,000 ft. Simla (Collett).	large ; branches spreading, covered with white powder like white-wash, prickles many, small, recurved ; leaves odd pinnate, stalk 1-2 ins., prickly, stipules $\frac{1}{4}$ in. long, linear-lanceolate, leaflets 3 or 5, ovate-lanceolate, 1-1$\frac{1}{2}$ ins. long, end one longer, doubly toothed, often lobulate, velvety above, white or

felted beneath ; flowers white, 1-3 together on slender drooping stalks, $\frac{1}{2}$-$\frac{3}{4}$ in. diam., calyx lobes 5, broad, long-pointed, petals 5, lobes rounded, stamens many ; fruit round $\frac{3}{4}$ in. diam., a column in the centre covered with 20-30 very small drupes, succulent, sweet, red, or orange, a minute stone in each drupe, pitted.

Rubus lasiocarpus,
Pakána, guràcha, karmach.
ROSACEÆ.
F. B. I. ii. 339.
Himalaya, 4-10,000 ft.
Simla, Mahasu (Collett).
Hazara (Barrett).

large ; branches spreading, smooth, pendulous, purple, often rooting at the tips, prickles small, flattened, few, often curved ; leaves 3-10 ins. long, midrib and stalks prickly, stipules $\frac{1}{4}$ in. linear awl-shaped, leaflets 5-9, ovate, lateral leaflets $1\frac{1}{2}$-$2\frac{1}{2}$ inches, end one rather larger, often lobed green, smooth above, white felted beneath; flowers dark pink, $\frac{1}{3}$-$\frac{2}{3}$ in. diam. in clustered woolly small branching racemes, calyx woolly, teeth 5, lanceolate, pointed, longer than the petals, petals 5, round, stamens many ; fruit same as the last species, but the drupes changing to black from blue or it may be orange or red, much eaten by Europeans and the natives.

Potentilla fruticosa,
Spangjhà, merino.
ROSACAÆ.
F. B. I. ii. 347.
Himalaya, 8-12,000 ft.
Hattu (Collett).

medium size, branches rigid or robust, sometimes prostrate, very leafy ; leaves crowded, odd pinnate, stipules large, membranous, blunt, leaflets 3-7, ovate-lanceolate, $\frac{1}{3}$-$\frac{2}{3}$ in., pointed, densely silky hairy above, smooth beneath ; flowers yellow, many, silky, calyx lobes 5, ovate or lanceolate, petals 5, much longer than the calyx, stamens many ; achenes many, hairy.

Potentilla Salessovii,
ROSACAÆ.
F. B. I. ii. 348.
Kashmir.
Lahul, 11-14,000 ft.

small, silky, stem woody, 1 in. thick ; leaves 4-6 ins., stipules membranous with a tail-like point, stalk thick, leaflets 7-9, oblong, blunt, coarsely bluntly toothed above the middle, white or green beneath base rounded ; flowers white 1 in. diam., very many, stalked in branching leafy clusters, calyx woolly, lobes 5, ovate or lanceolate, petals 5, oblong-ovate with a broad termination, longer than the calyx, stamens many ; achenes minute, hairy, enclosed in the hairs of the fruit base The fine powder under the leaves causes sneezing.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

NOT POD BEARING.

PETALS SIMILAR.

Rosa macrophylla, Rose.
Ban Gulab, Tumbi, Shingari.
ROSACEÆ.
F. B. I. iii. 366.
Himalaya, 4-10,000 ft.
Simla, Mashobra, Matiana, Narkanda (Collett).
Hazara (Barrett).

medium size ; prickly or smooth, prickles straight or curved with dilated bases ; leaves 2-8 ins. long,. stalk velvety, stipules large, broad, spreading, leaflets 7-11, nearly smooth, ovate, acute, teeth small, regular. lateral leaflets smaller the further they are from the end leaflet, which is ¾-3 ins. long ; flowers pink. solitary or in clusters, 1-2½ ins. diam., calyx lobes 5, narrow, thread-like, longer than the petals, tip often broad, toothed, petals 5, broad, stamens many styles ununited ; fruit red, sometimes 2 ins. long, crowned by the persistent calyx lobes, achenes large, ⅓ in. long, few or many.

Rosa Webbiana,
Kugina, Sikanda.
ROSACEÆ.
F. B. I. ii. 366.
Himalaya, 5-13,500 ft.

medium size, smooth, prickles many, ¼-¾ in., straight or curved with long bases, yellow ; leaves ½-2 ins., stipules small, leaflets 4-10, oblong or round, ¼-¾ in., base rounded ; flowers pink, 1-3 ins. diam., solitary, calyx round or oval, bristly, lobes long-pointed, tips broad, persistent, petals 5, heart-shaped with the broad part at the tip, stamens many, styles ununited- fruit ovoid or round, ½-1 in. diam., crowned by the persistent calyx lobes achenes many, ⅛ in. long pale.

Rosa sericea,
ROSACEÆ.
F. B. I. ii. 367.
Himalaya, 9-13,000 ft.
Hattu, Baghi (Collett).
Chur.

small ; branches quite smooth and unarmed or prickly only or bristly and glandular, prickles ½-1¾ ins., turned up, brown, broad, flattened ; leaves 1-3 ins., close set, stipules oblong, thin, with a short pointed tip, leaflets 7-9, oblong, acutely toothed towards the rounded tip, silky beneath ; flowers 2-2½ ins. diam., solitary, white or straw colour on short lateral shoots, calyx tube bristly grandular, lobes 5, velvety, ovate-lanceolate, persistent, petals 4, cordate with broad tips, stamens many, styles ununited; fruit nearly round, or pear-shaped silky or smooth, crowned by the persistent calyx lobes ; achenes few, ⅓ in. long.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

NOT POD BEARING.

PETALS SIMILAR.

Aralia cachemirica,
Banakhor, churial.
ARALIACEÆ.
F. B. I. iii. 722.
Kashmir, 9-12,000 ft.
Himalaya, 7-8,000 ft.
Theog, Narkanda (Collett).
Changlagalli (Douie).

medium size ; leaves pinnate or bi or tripinnate, end pinna with 5-9 leaflets, leaflets $3\frac{1}{2}$-$1\frac{1}{2}$ ins., oblong long-pointed, heart-shaped at the base, minutely toothed, hairy above, smooth beneath ; flowers white, small, many in round umbels, in simple or branching racemes, small or 12 ins. long, calyx 5 toothed, petals 5 reflexed, stamens 5 ; fruit small, succulent, drupe round, black $\frac{1}{10}$ in. diam., 5 ribbed, containing 5 bony one-seeded nuts.

PETALS NONE.

Zanthoxylum alatum,
Tejbal, timru.
RUTACEÆ.
F. B. I. i. 493.
Himalaya to 6,000 ft.
Simla (Collett).
Kasauli.
Hazara (Barrett).

large, strongly aromatic, bark corky, strong prickles on the branches, leaf-stalks and midribs of leaves and leaflets, branchlets dotted with white specks : leaves unequally pinnate, 2-6 ins. long, two stipular spines at the base of the winged leaf-stalk, leaflets 5-9, opposite, sessile, lanceolate, 2-4 ins. long, gland-dotted, margin with a few small teeth ; flowers small, yellow, crowded on small velvety lateral branching racemes, calyx 6-8 lobed, petals none, stamens 6-8 in male flowers, one to five oblique one-celled carpels in female flowers ; fruit of 1-5, small, pale, red, round drupes, one seed in each carpel, black, shining, used as a condiment ; the branches are used as tooth brushes.

Phyllanthus parvifolius,

see Shrubs, Alternate, Stipulate, Simple, Petals None.

(*To be continued.*)

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DESCRIPTIONS OF NEW GENERA AND SPECIES OF INDIAN ICHNEUMONIDÆ.

BY

P. CAMERON.

For the opportunity of describing of the new genera and species recorded in this paper I am indebted to Lieut.-Col. C. G. Nurse by whom they were taken.

PIMPLINÆ.

XORIDINI.

Agenora, gen. nov.

Areolet large, 5 angled. Transverse median nervure interstitial. Transverse median nervure in hind wings broken shortly below the middle. Median segment areolated; there is a triangular basal area; a large areola, clearly longer than wide, rounded at the base, transverse at the apex, 2 large Cater-alareæ, a spiracular area and one large one on the apical slope which is surrounded above and on the sides by a stout keel. Parapsidal furrows distinct; there is a distinct furrow on the lower side of the mesopleuræ. Head cubital; temples broad; occiput margined. Abdominal petiole long and slender, cylindrical, not perceptibly thickened towards the middle; the spiracles are placed almost in the middle. Anterior tibial not contracted at the base, not inflated, their tarsi twice their length; fore spurs large, broad, the 4 hinder minute. Occiput not quite transverse.

I only know the ♂ of this genus. In the arrangement of Ashmead (Proc. U. S. Nat. Mus. xxiii, 70.) it would come in near *cabocephalus*, Ratz., which may be known from it by the transverse median nervure not being interstitial and by the less completely areolated metanotum. Characteristic are the densely haired head and thorax.

Agenora hirticeps, sp. nov.

Black, shining, the head and thorax densely covered with long white hair; the 4 front legs pale fulvous, pale yellow at the base; the hind coxæ and femora red, the rest of them black; wings hyaline, the stigma and nervures black; tegulæ yellow.

Length 9 mm.

August.

The oral region has got injured and its precise form cannot be made out. Mandibles and palpi pale yellow; the former are broad at the base, becoming gradually narrowed towards the apex; I am not sure if they have 1 or 2 teeth, from their being bent accidentaly inwardlly. Scutellum large, roundly convex, but not much raised. First abdominal segment about one half longer than the second; it is covered with longish standing out white hair; the other segments with depressed white pubescence, which is thickest on the apical one. Base of hind tibial narrowed and curved. The abdomen is more than twice the *length of the thorax.*

TRYPHONINÆ.

TRYPHONINI.

Cyphanza, gen. nov.

Transverse median nervure in hind wings straight, unbroken, areolet oblique, irregular, petiolated, receiving the recurrent nervure near the apex. Disco-cubital nervure rounded, unbroken, not angled. Transverse median nervure in hind wings received shortly, but distinctly beyond the transverse basal Clypens not separated from the face, its sides above with a distinct fovea. Eyes parallel, not incised ; there is a distinct malar space, ocelli in a curve. Scutellum prominent, its sides not keeled. Metanotum with an elongated central basal area, about 6 times longer than wide, extending from the base to the apex, where it becomes narrowed to a sharp point ; there is a square, deep area on either side of the apex ; outerside there is a larger square area, not clearly defined above, the sides outside the spiracles are bounded by a keel, these 2 keels forming the outer boundaries of the outer apical area. Abdominal petiole longish ; its base half the width of the apex ; the sides at the base, are keeled to the spiracles, which are placed at the apex of the basal third of the segment. Antennæ moderately stout, longer than the body ; the 3rd joint is distinctly longer than the 4th calcaria short, as long as the 2nd tarsal joint ; the hinder metatarsus is as long as the following 3 united.

The radius is short, reaching half way between the apex of the stigma and of the wing ; it issues from shortly behind the middle of stigma. In the hind wings of the longitudinal nervures only the base of the radius is indicated. The temples and malar space are of moderate length. The metapleura separated from the sternum by a distinct keel. Mandibles broad, shortly, bluntly bidentate. There are small round spiracles near the base of the 2nd abdominal segment. Body and legs densely covered with short white pubescence.

In Ashmead's arrangement (Bull U. S. Nat. Mus. xxiii, 70) this genus runs near to *Gensia*, Foer.

Cyphanza nigra, sp. nov.

Black, densely covered with short, white pubescence, the face yellow, except for a black line on the upper two-thirds, the palpi testaceous ; the 4 anterior tibial and tarsi testaceous. Wings clear hyaline, the nervures and stigma testaceous.

Length 7 mm.

August.

Head and thorax closely punctured, the pleuræ more closely and strongly than the mesonotum.

Apex of clypeus broadly rounded, mesonotum and scutellum shining, the latter with a curved furrow at the base, centre of metanotum weakly, the sides more distinctly punctured. Pleuræ weakly punctured. The recurrent nervure is interstitial with the 2nd transverse cubital. The antennæ moderately stout, longer than the body, the flagellum densely covered with short black pubescence.

Inoresa, gen. nov.

Eyes large, parallel, incised on the innerside above, the malar space small, clypeus not separated from the face, its apex broadly rounded. There is a flattened plate between the antennæ. These have the 3rd joint fully one-fourth longer than the following, and clearly longer than the scape. Scutellum not much raised; keeled at the base only. Sides of metanotum margined by a distinct keel, abdomen flat, broad; the basal 2 segments become gradually widened; the 1st more than twice longer than the 2nd; the spiracles are placed shortly behind the middle. Wings without an areolet; the recurrent nervure is received shortly beyond the transverse cubital; the transverse median shortly beyond the transverse basal; the transverse median nervure in hind wings broken distinctly below the middle. Legs stout, short; the femora much swollen, the middle tibial with 2 spurs; claws large, simple. Mandibles broad, stoutly bidentate. Metanotal spiracles large, linear.

This genus in Ashmead's arrangements runs into *Ecclinops*, Foer, which may or may not be identical with *Acrogonia*, it agreeing with it in having the eyes emarginate within.

Inoresa pilosa, sp. nov.

Black, the mandibles, antennal scape, the scutellum, the metanotum from shortly behind the middle, apical third of 1st abdominal segments, and the 2nd and 3rd, except for a broad transverse mark on the base, pale luteous, the legs of a paler luteous colour, the apical half of hinder femora broadly on the innerside and the apex of the hind tibiæ, black; wings hyaline, the stigma testaceous, the nervures black. ♂

Length 12 mm.

Simla, August.

Densely covered all over with pale, slightly tinged with fulvous pubescence antennæ longer than the body, the scape yellow, the flagellum brownish rufous. Face and clypeus strongly, closely punctured. Front and vertex not so strongly punctured; there is a smooth bare space, triangular in space, below the ocelli, the hair is longer and denser on the face than it is on the upper parts; on these the hairs issue from a puncture. Mandibular teeth black, the base of mandibles thickly covered with silvery pubescence. Palpi yellow, covered with white pubescence. Thorax smooth; the hairs issue from tubercles. The pubescence on the pleuræ and median segment is longer and whiter than it is on the mesonotum. Abdomen smooth; the pubescence denser on the apical than on the basal segments, legs densely covered with long white pubescence.

MESOLEPTINI.

Letosha, gen. nov.

Wings without an areolet, the recurrent nervure received clearly beyond the transverse basal. Transverse median nervure interstitial. Transverse median nervure in hind wings broken shortly below the middle, but the longitudinal nervure is very faint, almost obsolete. Median segment long; with 2 stout transverse keels, the spiracles about 3 times longer than wide, clypeus roundly convex, clearly separated from the face by a suture, its apex broadly rounded. Eyes large, parallel; the malar space small. Scutellum longish, narrowed towards the apex, which has a long, oblique slope; its sides are margined. Legs long, slender; the hind coxæ long, about 4 times longer than wide; claws simple. Occiput margined, almost transverse. First abdominal segment long, slender, cylindrical, slightly dilated at the apex: the spiracles prominent placed shortly before the middle; the segments become slightly gradually widened to the last, which is obliquely narrowed.

The antennæ are longer than the body, filiform. Hinder calcaria short, not half the length of the 2nd tarsal joint, ocelli large, the hinder separated from each other by a slightly less distance than they are from the eyes. Temples wide, obliquely narrowed; the occiput has a sharply oblique slope from the ocelli and are margined. Parapsidal furrows indicated at the base, narrow. Apex of pronotum dilated. Fore tarsi long, slender, clearly longer than the tibiæ. There is a wide depression on the lower apical half of the mesopleuræ and a shorter narrower curved one on the base of the mesosternum. Pterostigma large, longish, the radius issues from shortly beyond its middle, the transverse cubital nervure is short. Mandibles unequally bidentate.

The precise affinities of this genus may be left over until its ♀ is known. From the position of the abdominal spiracles I refer it, for the present, to the *Tryphonidæ*, Tribe *Mesoleptini*.

Letosha longicoxis, sp. nov.

Black, the face, clypeus, mandibles, palpi, a somewhat triangular mark on the apex of the pronotum, the lower edge of the propleuræ, the lower inner orbits broadly, the mark gradually narrowed above and a narrow line down the base of the metapleuræ, pale yellow, the apex of the scutellum, the apex of the 1st abdominal segment narrowly, the base of the 2nd somewhat more broadly, the base of the 3rd still more broadly, and the whole of the 3rd rufotestaceous. Legs rufo-fulvous, the anterior paler; the hind coxæ, apex of hind tibiæ broadly and the basal half of metatarsus black; the rest of the hinder tarsi white. Wings hyaline, the stigma fusevus, the nervures black.

Length 8 mm.

Simla, August.

Antennæ filiform longer than the body, black, the pedicle testaceous, the flagellum densely covered with short, stiff pubescence. Head, prothorax, mesonotum and scutellum smooth and shining, the lower part of the mesopleuræ closely, strongly, longitudinally striated, the upper part and the greater part of the apex smooth and shining; the metapleuræ coarsely rugosely reticulated. Basal part of metanotum smooth, depressed in the middle at the base; its apex irregularly, obscurely striated; the part between the 2 keels is strongly, irregularly striated; the apex is irregularly striated laterally. Metapleuræ coarsely irregularly, closely, obliquely striated. Hind coxæ closely, coarsely, transversely striated.

CTENOPELMINI.

Fintona, gen. nov.

Areolet 4-angled, the nervures meeting in front ; the transverse median nervure received beyond the transverse basal ; the transverse median nervure in hind wings broken below the middle, the median nervure distinct. Metanotum not areolated, longish, the top of apical slope bordered by a stout keel. Abdominal petiole longish longer than the 2nd segment, the base half the width of the apex, not widened behind the spiracles ; the 2nd and 3rd segments longer than wide, the 4th square. Clypeus separated from the face by a shallow furrow, roundly convex, its apex rounded. Claws pectinated : the pectinations strong at the base only and few in number. Ocelli wider from each other than to the eye margin. Vertex separated from occiput by a weak indistinct keel. Sheaths of ovipositor shortly projecting, not much longer than the last segment. Clypeal foveæ without a hair tuft. Legs long, slender, as are also the antennæ.

If the abdomen is to be called " petiolate," this genus, in Ashmead's tables, would come in near *Eczetesis*, Foerster. It is a slenderly built form with long, slender legs, more like an Ophionid than a Tryphonid.

Fintona nigripalpis, sp. nov.

Black ; the abdomen from the 2nd segment red, the apical segment darker coloured ; the legs similarly coloured, the hind tibiæ and tarsi black, the other tarsi infuscated ; wings hyaline, the stigma and nervures black. ♀

Length 11 mm.

Simla, August.

Head, pro-and mesothorax closely, somewhat strongly punctured : the metanotum much more strongly punctured, more or less reticulated in the middle ; the apical transverse keel stout, smooth ; the part below it closely punctured, more or less striated. Areolet 4-angled, the nervures meeting in front, the recurrent nervure received before the middle ; the disco-cubital and the recurrent nervures largely bullated. First abdominal segment closely strongly punctured, more or less striated in the centre, narrowly at the base, more strongly near the apex, the 2nd segment is closely, strongly, the 3rd not so strongly punctured. Antennæ longer than the body, slender ; the 3rd joint distinctly longer than the 4th. Tarsi closely pilose. Palpi black, stout, covered with white pubescence.

Pauroctenus, gen. nov.

Wings with an areolet which is small, triangular, oblique, the recurrent nervure interstitial with the 2nd transverse cubital. Transverse median nervure received shortly beyond the transverse basal. Transverse median nervure in hind wing broken distinctly below the middle clypeus separated from the face, but not by a distinct furrow at least in the centre, its apex broadly rounded.

Base of metanotum with 5 large area, including a spiracular; the central is of equal width and is fully twice longer than wide, there are 4 wide areal on the apical slope, the central apical keel is received in the middle of the areola. Spiracles almost circular. Basal segment of abdomen sessile, twice longer than wide; the back on the basal half with 2 keels. Legs normal, longish, the claws with long spines. The nervures in the hind wings are distinct. Clypeal foveæ large, bare, occiput bordered by a distinct keel. Basal joint of flagellum not much longer than the 2nd. Face not much dilated.

The affinities of this genus may be left over until the ♀ is known. It comes near *Polyblastus* in the tables given by authors.

Pauroctenus pallipes, sp. nov.

Black, shining, the tegulæ, clypeus, mandibles, palpi and legs pale yellowish, tinged slightly with testaceous; the apex of the hinder tibiæ and the hind tarsi except the basal half of the metatarsus blackish; wings hyaline, the stigma testaceous, the nervures darker coloured.

Length 6-7 mm.

Simla, August.

Shining, smooth, except the face, which is distinctly punctured; covered with short pale pubescence, which is longest on the abdomen and on the metapleuræ. The basal segments of the abdomen are shagreened.

Monoblastus orientalis, sp. nov.

Black, the apex of the 2nd, the whole of the other abdominal segments and the sheath of ovipositor bright ferruginous; the anterior tibiæ and tarsi below dark testaceous; the mandibles dark testaceous before the middle; the body and legs densely covered with short white pubescence, wings hyaline, the nervures and stigma black; the areolet distinctly appendiculated, the pedicle as long as the basal transverse cubital nervure which is straight, oblique, the apical is longer, is roundly curved and largely bullated below; the recurrent nervure is interstitial with it.

Length 6 mm.

Simla, September.

Head and thorax finely, closely punctured, the mesonotum more weakly than the pleuræ. Metanotum with 3 large areal on the basal part, the central being the smaller and having the keels slightly curved, there being also a keel outside the spiracles; there are 4 squarish areæ on the apical slope, the outer being irregularly longitudinally reticulated: the lower, basal part of the metapleuræ irregularly obliquely striated, the striated part bounded at the apex by a keel. Basal 2 segments of the abdomen closely punctured; the 1st with a longish, deep depression at the base, this being bordered by narrow keels which extended beyond it, the sides below being also keeled.

The transverse median nervure in hind wings is broken below the middle: the longitudinal nervure, as are also the upper ones, being faint; the transverse median nervure is received distinctly beyond the transverse basal.

BASSINI.

Sussaba, gen. nov.

♀ Antennæ 22-jointed, the last joint twice the length of the preceding, wings without an areloet; transverse median nervure in forewings interstitial; in the hind wings it is broken almost in the middle. Clypeus separated from the face, its apical two-thirds depressed, the apex transverse. Scutellum roundly convex, the sides keeled to the middle. Metanotum with 2 stout curved keels in the centre of the base. Basal segment of abdomen sessile, longer than the 2nd, its spiracles prominent, the 2nd segment with thyridia: ovipositor prominent, broad.

The abdominal spiracles are placed well behind the middle; the sides beyond them are bordered by a keel; the 2nd segment has no keels; the 2nd segment is clearly longer than wide. The mandibles have their teeth below united by a membrane, the projecting apical parts of the teeth thus being short. Face and clypeus almost bare, not curved with silvery pubescence. The malar space is nearly as long as the antennal scape. Occiput and cheeks margined. Middle tibial with 2 spurs; the 3rd joint of the tibial is slightly longer than the last; the long spur of bind tibial one-third of the length of metatarsus.

This genus looks very like a *Bassus*. In the arrangement of Dr. Ashmead it would come in near *Syntactus* and *Calliphrusus*.

Sussaba bicarinata, sp. nov.

Black, the base of mandibles, palpi, tegulæ and a spot on apex of pronotum and a very narrow line on its base, yellow; the gastrocœli, the apex of the 2nd and the base of the 3rd abdominal segments narrowly rufous. Legs black, the fore legs almost entirely, the middle femora above, and the 4 hinder tibial below, testaceous, the calcaria pale testaceous. Wings hyaline, the nervures and stigma black.

Length 5 mm.

September.

Head smooth and shining; the clypeus clearly separated, the lower part depressed, obscurely longitudinally striated. Mesonotum closely, strongly punctured. Scutellum roundly convex, the sides of the base keeled. Metanotum at the base irregularly rugose; its centre with 2 keels which diverge roundly at the apex; the apical slope closely, rugosely transversely striated. Pleuræ smooth, the lower part of the pro-and metapleuræ striated. Median segment thickly covered with white pubescence. First abdominal segment somewhat strongly longitudinally striated, the strial interlacing; the basal half of the 2nd finely, closely regularly striated; the other segments are smooth; the sheath of the ovipositor is longish.

Bassus indicus, sp. nov.

Black, the face, clypeus, a broad line on the lower part of the inner orbits, mandibles except at the apex, palpi, a large mark on the sides of the mesonotum commencing at the tegulæ narrowest at the apex, dilated inwardly at the base, apical half of the propleuræ, the mark gradually narrowed below, the greater part of the lower half of the mesopleuræ, the mark widest at the apex, a line on the base of the metapleuræ, scutellum, narrow lines on the apices of the abdominal segments, the lines on the apical segments indistinct. Legs fulvous, the 4 anterior paler, more yellowish in tint; the apical third of the hind tibial and the hind tarsi black. Wings hyaline, the nervures and stigma black.

Length 6 mm.

Simla, August.

Antennal scape yellow, the flagellum brown beneath. Head smooth, the centre of the face bordered by a furrow, which is wider and deeper above than below. A distinct furrow on the middle of the front, the part on either side of it closely punctured. Mesonotum closely, distinctly punctured: the scutellum sparsely punctured in the middle, apical slope of the metanotum with a broad, curved depression above. Basal two segments of abdomen opaque, distinctly aciculated-punctured, the centre of the 1st and the base of the 1st closely finely striated; the 1st is twice longer than it is wide at the apex, the spiracles are prominent. There are no keels on the metanotum, nor transverse furrows on the abdominal segments. The 1st abdominal segment is longer compared with the 2nd than it is in *B. laetatorius*. The incision in the centre of the clypeus is distinct.

The European (now almost cosmopolitan) species *Bassus laetatorius*, F., is now found in India.

CRYPTINÆ.

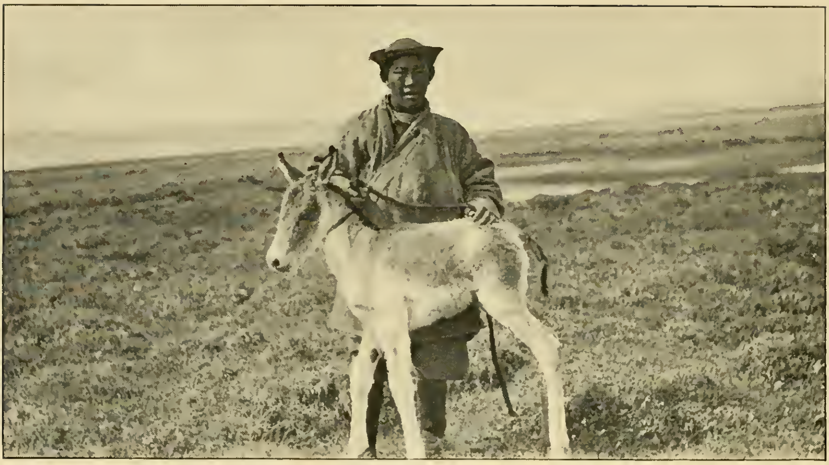
Distantella pilosella, sp. nov.

Black, the face, clypeus, mandibles except the teeth, palpi, inner orbits narrowly, the outer from shortly above the middle, the line obliquely narrowed above, a narrow line, not extending to the base, on the pronotum, a broader, complete one on the lower edge of the propleuræ, tubercles, apical half of scutellum and tegulæ pale yellow; the apices of the abdominal segments narrowly testaceous, legs: the 4 anterior yellow, tinged with testaceous, the hind coxæ and trochanters black, the femora dark rufous: the tibial on the basal half testaceous, paler at the base, the rest blackish; the tarsi white, the basal half of the basal joint black. Wings clear hyaline, the nervures and stigma black. Antennæ black, the scape yellow below.

Length 12mm.

Simla, August.

Face and clypeus closely punctured, thickly covered with white pubescence: the front below the ocelli aciculated, finely irregularly reticulated. Pro-and mesothorax strongly punctured, the pleuræ more or less finely striated. Basal half of scutellum more strongly and sparsely punctured than the mesonotum; its apical slope more strongly and closely punctured. Base of metanotum behind the keel closely, strongly punctured; the space between the keels punctured on the outerside, the middle irregularly striated and with some scattered punctures; the apical slope strongly, irregularly, mostly longitudinally reticulated, the basal keel is distinct, roundly curved narrowly backwards in the middle; the apical keel is more irregular and more broadly rounded backwards. Areolet of moderate size, narrowed in front; the recurrent nervure is received shortly behind the middle. The mesopleural furrow is much widened at the base and is crenulated in the middle. Tibiæ and tarsi spinose.



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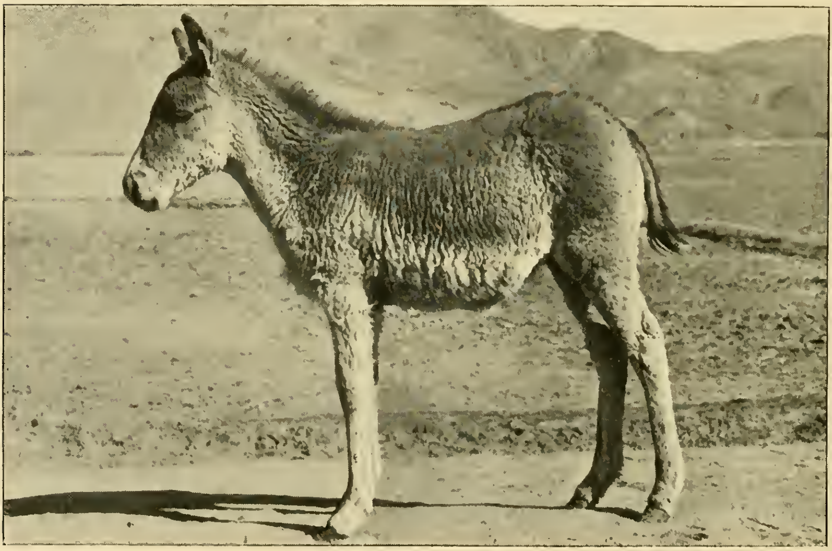

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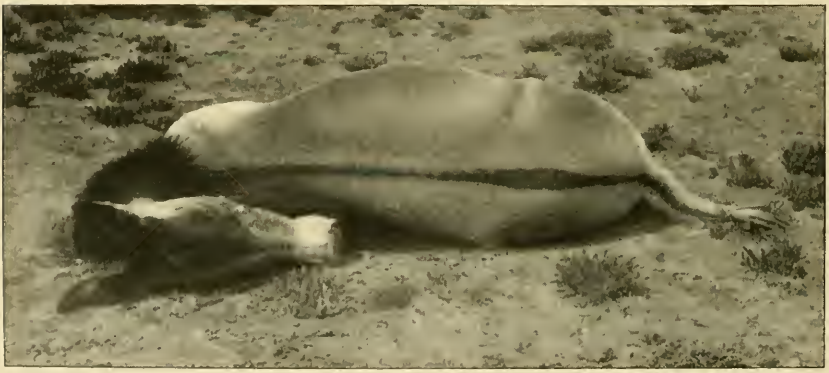

3.

THE TIBETAN WILD ASS *(Equus hemionus).*

1. Young Kiang (female) on day of capture, age about 10 days.
2. Young Kiang (female) at age of about 4 months.
3. Adult Kiang (female).

A YOUNG KYANG OR TIBETAN WILD ASS (*EQUUS HEMIONUS*).

BY

F. M. BAILEY.

(*With Plate* A.)

I send you two photos of a young female Kyang (*E. hemionus*) together with a photo of the mother which I was obliged to shoot before I could capture the young. I caught the young one on the 11th August 1908, near Dochen, Tibet, at an altitude of 14,700 feet. The age then, as shown by the teeth, was about ten days and the height at the shoulder was about 31 inches. After the mother was shot, the young one was chased on ponies till she reached marshy ground over which it was impossible to ride; but as soon as we ceased riding after her she came quite fearlessly up to a pony and allowed herself to be captured. The first photograph shows the young Kyang immediately after capture and the second is of the same animal when about 4 months old. At the time of writing she is 8½ months of age and measures 43 inches in height at the shoulder. This animal is now quite tame and feeds readily from the hand and follows her foster mother when ridden about the country; but her temper is somewhat uncertain. The movements are graceful and she readily jumps the ditches which irrigate the country round Gyantse. The photograph of the dead mother (fig. 3.) gives a good idea of the large bare plains which these animals inhabit.

The following are the measurements of the adult in the photograph—

Head and body	80½″
Tail (without end hairs)	12½″
Height at shoulder	48½″
Total length from nose to tip of tail	113″

THE ADAPTATIONS OF AQUATIC INSECTS TO THEIR ENVIRONMENTS.

BY

GORDON DALGLIESH.

That all insects were at one time terrestrial is the opinion of most Zoologists, and the means by which many have adapted themselves to an aquatic life is one of the most interesting of Biological studies. Few insects are strictly aquatic in the true sense of the word, some being only so for a period of their lives, others making use of the upper world for respiration or for purposes of migration from one spot to another. No insect when fully adult breathes air dissolved in water. Water clear as crystal supports various forms, while again others can only exist in water which is so putrid with decaying matter as to render the stench arising from it insupportable. From an economic point of view the larvæ of many aquatic species are useful to mankind in keeping pure the waters of pools or ponds that would otherwise become disease-laden. Professor Miall tells us that the eggs of a species of *Corixa* are used as an article of diet by Mexicans. These eggs are ground up with meal and made into cakes.

For the study of aquatic insects some sort of vessel made of glass is absolutely essential for observation at home, the most useful being a bell jar which should be filled with pond water and plenty of aquatic weeds to keep the water fresh. It must, however, be borne in mind that only certain species can live together in harmony, the carnivorous and rapacious species such as many water beetles and their larvæ must be isolated. A good compound microscope and pocket lens are of great service for watching in a dead or living state many species. For the observation of small aquatic larvæ under the microscope a " life slide " is necessary.

These are sold by all dealers in microscopic appliances. The most useful I have found being the " Darlston Life Slide ".* This is made of vulcanite, measuring 3½ × 2 inches and has in the middle a shallow oval depression of glass for the reception of water and insect. When all is ready for observation a glass slip covers the cavity in such a manner as to render leakage impossible. This slide will be found of great service in watching the respiration of *Ephemera* and *Culicidæ* larvæ. For the formation of a collection of aquatic insects two nets will be required. One, the water net, should be made of stout muslin in the form of a wide but not too deep bag. The bag fits on to an iron ring, this fitting into a brass socket which is attached to a stout stick of suitable length. This is solely for aquatic work and should be used freely in sweeping about the weeds and for capturing any insect on the surface. The second net required is the ordinary " butterfly " net, the bag being made of the finest muslin possible, and yet strong enough for the capture of the swift and powerful flying dragon flies, at the same time being supple and light for the capture of such delicate insects as May and Caddis flies and gnats. All insects caught are better killed in the usual lethal chamber of Entomologists—the "killing bottle." Large dragon flies can be first disabled by a sharp quick pinch on the thorax. Great care must be exercised in the manipulation of delicate species of *Ephemera*, *Trichoptera*, and *Culicidæ*. The *Ephemera* are delicate insects and well nigh impossible to preserve with any satisfaction in a dry state owing to their bodies shrinking after death so as to render identification impossible. One at least out of every species caught should be preserved in spirit. *Culicidæ* can either be preserved in a dry state or as microscopic specimens. Beetles and aquatic bugs can be preserved in a dry state, and their legs, antennæ, etc., set so as to allow an easy examination of these parts. This also applies to the dragon flies and the more robust species of *Trichoptera*. All aquatic larvæ must be preserved in spirit.

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* To be obtained from Mr. Thos. Balton, Balshall Heath Rd., Birmingham.

The Caddis flies (*Trichoptera*) are a small order of insects of which I am informed by Mr. Lefroy, Imperial Entomologist, about thirty Indian species are known to entomologists, and no doubt there are many others awaiting determination by some enterprising person who will make these a special object of study. Collectors have hitherto somewhat neglected this interesting order, the reasons no doubt being that Caddis flies when caught and "set" do not form as attractive an appearance as the more showy butterflies and moths. Some species are comparatively large, others again are extremely small. In appearance Caddis flies resemble moths so closely that they are often mistaken as such. Great difference of opinion has existed between naturalists as to the true position of these insects. They have been included with the *Hemiptera* and *Lepidoptera*, but now it is generally agreed that they form a separate group. The main distinguishing feature of the order is the wings which are covered with small hairs. (Greek τριξος hair, and πτερος wing.) Caddis flies are seen more generally in the evening dancing lightly over the water in small groups. The antennæ are long and composed of many joints. The body of a Caddis larva is soft, white and utterly unprotected and therefore liable to the attacks of many foes. To guard against this the larva makes itself a case of stones, sand, bits of stick, dead shells, and a variety of other materials which it may find in the water. Within this tube is a silken thread-like covering, or, rather I should say, the silken covering is spun first and the outside cover attached to this. This hollow cylinder enclosing the larva is open at both ends. If a larva be drawn from its tube and examined with a lens at the hinder end of the body two hooks curving inwards will be observed. These serve to secure the insect firmly to its tube. The resistance these hooks offer will be appreciated by those who have ever tried to drag a living larva from its case. The larva is at all times totally submerged and can therefore only obtain air from the water though the exact mode of respiration has not quite been determined. Prof. Miall quoting Mr. Taylor says—"The animal is not however still but at intervals waves its body up and down causing a stream of water to flow through the case from the head end. The undulations begin at the second abdominal segment and pass backwards to the tail end just as a piece of string which is fixed at one end and waved up and down at the other. The rest of the body is kept steady so that the stream of water has a free admission. This seems to be effected by the lateral process of the first abdominal segment which can be pressed against the sides of the case and kept from slipping by the spines which cover their points."

Again, the same gentleman quoting Dr. Schmidt-Schmedt says—"The larva moves its abdomen up and down most probably to renew the water which bathes its body, and that the fringed sides (which Réamur supposed to be an analogy with the gills of fishes) by increasing the breadth of the abdomen, add to the effect." It is just possible too Caddis larvæ are able to store up air by means of the silken covering, in the same manner that certain aquatic caterpillars (*Hydrocampa*) do which also form a silken covering, and like the Caddis larvæ are completely submerged and carry on respiration entirely by means of stored air. Aquatic spiders are able to breathe when submerged by carrying bubbles of air down with them entangled in the fine hairs covering the body.

The breathing of a water beetle (*Dytiscus*) larva offers a contrast to that of a Caddis larva. Larvæ of aquatic beetles *must* come to the surface to breathe. The tail end of the body is thrust above the surface and air absorbed from the atmosphere by means of two tracheal trunks, one in each appendage, these trunks being continuous with two air vessels running longitudinally throughout the length of the body and branching off into tracheæ to each segment. An adult water beetle breathes very much in the same way, the body being lighter than the water rises to the surface when the insect ceases its exertions beneath the surface. The end of the abdomen is thrust above and the wing cases raised to admit air bubbles which are lodged between the wing cases and the back of the abdomen and kept there by a quantity of soft hairs, the air being absorbed by the spiracles. Around the spiracles of some *Dytiscid* beetles are certain cells which bear a close analogy with those of plants. A quantity of air may be stored up at one time which passes from the lower spiracles to the front ones. The hinder end of the body of an aquatic beetle is considerably lighter than the fore-end, and this can be seen easily in the family *Dytiscidæ* when any members of it are confined in a glass vessel. They will then be seen to swim nearly always in a horizontal position, rarely a lateral one, and the tail end always pointing to the surface of the water. The respiration of the larva of a gnat or mosquito is effected in the same way as that of a water beetle larva, and this manner of breathing is a distinct advantage to both insects. The early lives of both water beetle and gnat are principally spent in either feeding or searching for food, and as this is always obtained *beneath* the surface of the water both insects have to be always on the look out for it, and must therefore have their heads submerged so that no time may be wasted between their search and acts of respiration. The larva of a gnat is decidedly heavier than the water. How is it then able to remain suspended at the surface? To explain this it will be necessary to say something about the surface film. By means of this surface film other aquatic insects are enabled to run along the surface of the water (as certain kinds of *Gerris*). The surface of water is covered with an invisible film and it requires a certain amount of mechanical force to break through this. A simple experiment may be made to demonstrate this surface film. Gently lower a needle on the surface of still water and it will float, but, by applying just sufficient pressure to force one end of the needle through the film it at once sinks. Hence the larva of a gnat is enabled to suspend itself tail upwards to the surface film by means of its respiratory syphon which has fine flaps open or closed at will by means of certain muscles. When these flaps are open they form a hollow which does not allow the surface film to enter. As the larva rises to the surface the ends of the flaps come in contact with the surface film and adhere to it. The muscles then draw apart the flaps and the hollow formed is expanded and filled with air. The surface film now is pulling the edges of the hollow and this is sufficient to counterbalance the greater density of the body of the larva, which hangs without effort from the surface (Miall).

When the larva wishes to descend the valves are closed their tips being brought to a point and the resisting pull of the surface film is reduced to an unimportant amount. I once watched the movements of a number of whirligig beetles (*Gyrinus**) in their whirling dance which was kept up at intervals of five minutes They then rested in a conglomerated mass freqnently head to head, any stray member outside the mass always sooner or later being attracted to it without any movement on the part of the insect whatever. This was no doubt due to the contraction of the surface film. The respiration effected by the pupa of a gnat is extremely interesting and exactly the reverse to that of the larva. The pupa of a gnat unlike many other species is active and not quiescent and always remains suspended to the surface film head uppermost. The head end is composed of the wings, legs and antennæ which can all be seen folded up in their place by aid of a microscope, at the tail end are a pair of swimming flaps. Like the larva the pupa is supplied with external air and obtains this by means of a pair of tubes behind the head, the tops of which always remain flushed with the water. When the pupa descends below the surface water cannot enter the tubes on account of certain hairs found on their inner walls. When the pupa rises from below the tubes are covered by a film of water which bursts when the surface is reached. The inversion of the organs of respiration in larva to pupa is explained when the time of emergence of the perfect insect takes place. Gnats in their perfect state avoid getting wet as much as possible and the slightest immersion would be fatal to them. The fly escapes from the pupa skin through a slit in the upper portion of the thorax and emerges high and dry without touching the water on the back of the cast pupa skin. The larva of a dragon fly always creeps along at the bottom of the water among the mud and debris and rarely comes to the surface to breathe. It has a well developed tracheal system but there are no open stigmata on the body surface showing that water carries the air through their walls. The walls of the rectum have many folds, around the membrane of these are small tracheal tubes which communicate with two main tracheæ running longitudinally through the body one for each side. A number of tubes branch from these penetrating every part of the body bringing the whole tracheal system into direct communication with the water cavity of the abdomen. Water is taken in by means of the rectum and the oxygen contained in it passes in solution through the walls of this cavity. The oxygen passes through the tracheal vessels in every part of the body, and through the rectum is expelled the waste products in the form of carbonic acid gas. At the hinder end of the body of certain dragon fly larvæ (*aqrionidæ*) are three thin leaf-like plates. These appendages are respiratory as well as being organs of locomotion. These larvæ breathe by dissolved oxygen conveyed to the body by means of these plates which, when microscopically examined, are found to be covered with very fine tracheal tubes. The pupæ of dragon flies differ very little from the larvæ and are quite as active. The larvæ of dragon flies have a peculiar arrangement for the capture of their prey known as the " mask " which is in reality a modification of the labium or lip. This " mask ". so called because it covers the front of the head consists of two parts. When not in use the "mask " is folded up, the broad portion spreading over the mouth, and the other part bent backwards between the front limbs. When the larva wishes to feed (all dragon fly larvæ are highly carnivorous) this mask arrangement is shot suddenly out and the prey captured by the pseudo-jaws. The mask is then retracted bringing the food to the mouth. I may mention here that both dragon flies,and their larvæ are extremely tenacious of life. A larva I procured of the family *Libellulidæ* for the purpose of dissection was thrown into nearly boiling water and removed after half a minute and appeared quite dead when first taken out but eventually recovered and lived for some time after. I once caught some dragon flies of the same family and after first disabling them by a pinch on the thorax placed them in a box with a strong solution of ammonia, and found they still retained signs of life two hours after. Dragon flies have extremely small antennæ, indeed these organs being merely rudimentary. This is made up to them however by their large and well developed eyes. Large antennæ to such creatures of wild and rapid flight would, I should imagine, be more of a hinderance than a help to their owners. The laying of eggs of dragon flies varies in the different species. Some enter right under the water for the purpose of doing so, others again alight on the surface of the water. I watched a large *Libellula* depositing its eggs which was effected in the following manner :—The insect hovered closely over the water and bent the abdomen so that the tip nearly touched the under-part of the thorax, then with a succession of jerks the eggs were laid one after another. The water was too deep to allow me to wade in and see whether the eggs floated or sunk. If the wing of a dragon fly be examined it appears to the naked eye like fine gauze. If this be examined under a microscope with a $\frac{1}{6}$ objective a very wonderful and curious arrangement presents itself. Each of the nervures are covered with curious protuberances exactly resembling thorns. I have often wondered and puzzled as to what could be the use of these "thorns" and I have now come to the conclusion that they act as a stiff support to the more delicate portions of the wing and as an additional strength helping the dragon fly to sustain its powerful flight. These "thorns" too may cause the characteristic rustling of the wings when in flight. The wings of various gnats are fringed with long stiff hairs which may cause the piping hum of these insects. The surface of the gnat's wing too is closely covered with short dark hairs. A very similar arrangement is found on the wings of *Dytiscid* beetles. These hairs may be of use as a protection against unnecessary damp, protecting the gnat from rain and damp atmosphere and the beetle from getting the delicate membrane wet when submerged. These hairs can only be seen under a high power of a microscope.

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* Gyrinidæ are abundant in India, the commonest being *Dineutes indicus* (Lefroy *in lit*).

In the legs of aquatic insects we find many wonderful and beautiful contrivances. In the larvæ of some, these may either be well developed as in the case of water beetles, May, Caddis, and dragon flies, merely taking the form of hairs in gnats and entirely wanting in many aquatic *Diptera*. The "feathered" legs of various adult water beetles and water boatmen (*Corixa, Notonecta*) are so arranged as to enable their owners to propel their bodies with ease through the water. In the larger *Dytiscid* beetles the fringe of hairs on the hind legs are remarkably long and stiff. The tarsi of these limbs rotate upon their axis when the insect is swimming, and as Dr. Sharpe remarks :—"In other words, what rowers call feathering the oar is performed by the tarsus of the *Dytiscidæ* in a most perfect manner." Most curious of all is the wonderful modification of the tarsus on the fore leg in the males of many *Dytiscid* beetles in the form of suckers. It is now generally supposed that these suckers are used for the firmer detention of the female, and perhaps serve too in the capture of prey.

One of the most beautiful of microscopic objects is a properly prepared fore-leg of a *Dytiscid* beetle. On the undersurface of the circular disc are numbers of small stalked bodies, and on the first tarsal joint are seen two larger structures. The sucker is composed of three joints and is fringed with stiff hairs. On one species of *Dytiscus* no less than 170 sucking hairs have been counted. Experiments have been made as regards the adhesive power of these suckers, and it was found that a beetle by means of these could support more than thirteen times its own weight. Another curious modification is found in the hind limbs of whirligig (*Gyrinidæ*) beetles. In these they are short, broad and powerful, and their structure has been aptly likened to an ivory memoranda tablet held together by a pin, so that they can either be opened fan-wise or closed in a moment (Miall). The fore limbs in these beetles are long and prehensile. Other aquatic insects have their fore limbs modified so as to take the place of jaws for capturing prey as in *Naucoris, Nepa*, and the giant Indian water bug (*Belostoma indica*). In *Nepa* the limbs are very peculiar and are bent inwards and can be closely folded, the fore part having a groove which receives the tarsus.

The *Ephemeridæ* or May flies have attracted the attention of Naturalists from early times, and most of our knowledge relating to these beautiful insects are due to the indefatigable labours of Swammerdam, Malpighi, Réaumur and De Geer. When we read that the tools employed by Swammerdam for the dissection of a May fly larva were so fine as to require whetting under a microscope we can truly appreciate the fine work done by him. Though this naturalist wrote in 1675 little further has been added to his knowledge of the *Ephemeridæ.* May flies are extremely delicate insects having the anterior wings largely developed and the posterior small or wanting. They have a rudimentary mouth, and the body ends in two to three long anal setæ. May flies are remarkable for undergoing four distinct changes before maturity instead of three. The fly when it first emerges from the pupa resembles the adult fly but is known then to Entomologists as a pseudo-imago, that is to say another skin is cast before the insect finally flies away. Another peculiarity of the *Ephemeridæ* is the short duration of life of the perfect insect, and the popular idea is that they invariably die after the sunset preceding their time of development from pupa to imago. Many of them, it is true, live for a few hours only, though a period of two days is on record. I myself have proved that their vitality is not so feeble as is generally supposed. One specimen was on my setting board for three days and then still retained signs of life, for when touched it responded by gently waving the long setæ to and fro although it had previously lain in the killing bottle for quite five minutes. The long hair-like setæ when examined under a microscope bear a close analogy in structure with the antennæ of many insects, and doubtless serve the function of such, the true antennæ being very small. In support of this I have frequently held live May flies by their wings and they invariably moved the setæ in exactly the same manner that many insects move their antennæ. A similar structure is found in the Mole crickets (*Gryllotalpa*) which possess tail appendages covered with stiff hairs. These act as delicate organs of perception by the insect when moving backwards in its subterranean progress. I have microscopically detected further abdominal appendages on one species of May fly resembling those of dragon flies. These may be claspers and used by the male to hold the female. Very little is known of the Indian *Ephemeridæ.* "Less than thirty species are actually recorded but some are quite abundant in rivers" (Lefroy *in lit.*). Their flight is very pretty to watch. They ascend in a soaring manner with the wings hardly moving, then descending again very rapidly. The eggs of May flies are laid on the surface of the water, the whole quantity being deposited at the same time. The eggs being heavier than the water sink immediately. The larvæ when hatched burrow into the mud. Their bodies are composed of fourteen segments and the head is provided with long slender antennæ. They also possess setæ covered with short hairs. The mandibles are long and curved. The organs of respiration approach closely in structure to the gills of higher animals and consist of leaf-like plates arranged on each side of the body. These, when the living larva is reviewed under a microscope, are seen to move up and down with great rapidity. The larva grows but slowly, some taking two years to complete their metamorphosis. The pupa is active and resembles the larva and traces of rudimentary wings only distinguish it from the latter May fly larvæ never come to the surface to breathe and always obtain their oxygen from the water. Aquatic insects may be divided into—

(1) Those that spend only a portion of their lives in the water=*Culicidæ*, *Odonata*, *Trichoptera*, *Ephemeridæ*.

(2) Those that spend nearly all their lives in the water=aquatic *Coleoptera* and *Rhynchota*.

(3) Those with quiescent pupæ=*Coleoptera* and *Trichoptera*.

(4) Those with active pupæ=*Culicidæ*, *Rhynchota*, *Odonata* *Ephemeridæ*.

(5) Those with active pupæ differing greatly from adult insect=*Culicidæ*, and other aquatic *Diptera*.

(6) Those with active pupæ hardly differing from the larvæ=*Odonata*, *Ephemeridæ*.

(7) Those with active pupæ hardly differing from adult insects = *Rhynchota*.*

(8) Those which come to the surface to breathe=*Culicidæ* (larvæ and pupæ), *Rhynchota* (larvæ, pupæ and adult), *Coleoptera* (larvæ and adult).

(9) Those which rarely come to the surface to breath=*Odonata* (larvæ and pupæ).

(10) Those which never come to the surface to breathe=*Trichoptera* and *Ephemeridæ* (larvæ and pupæ).

(11) Those which undergo *no* metamorphosis and are aquatic all their lives = *Poduridæ*.

It is easy to see why the pupæ of many aquatic insects are active. Subject to the attacks of many foes few would stand a chance of arriving at maturity had they no means by which to escape. Those insects with quiescent pupæ as aquatic beetles and Caddis flies protect themselves by the former pupating in the mud by the side of ponds and the latter in their cases. It was shown in the first part of this paper how the pupa of a gnat breathed and its mode of progression from beneath the water to the surface or *vice versa* is very curious. At the hinder end of the body is a broad and powerful swimming organ shaped like the telson of a crayfish or lobster. When the pupa wishes to rise or descend this swimming organ is flapped violently towards the head end. By constant flapping the pupa describes a series of somersaults and rises or descends in a complete circle. This is easily observed if some gnat pupæ be confined in a glass of clear water.

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* It is doubtful if the term pupa is allowable in this order (*vide* B. N. H. S. J., Vol. XVIII, p. 182), but for the sake of convenience I have made use of it here.

The hairs of aquatic insects and their probable uses form an interesting study in themselves. These may be divided into five classes :—

(1) Those that aid respiration.
(2) Those that aid feeding.
(3) Those that aid swimming.
(4) Those that serve for protection.
(5) Those that act as organs of perception.

(1) Situated near the spiracles of a *Dytiscid* beetle are a number of stiff hairs, which when viewed under the high power of a microscope present an appearance of pin-like structures the head of the pin fixing the hairs to the body. These hairs entangle the air bubbles and moreover, prevent water from getting into the spiracles and also serve to keep the wings dry. In some of the aquatic *Rhynchota* (*Notonectidæ*) the hinder abdominal spiracles are very small and near these are tufts of hair which entangle air bubbles and serve to protect as well the spiracles. " Larger spiracles, well defended by hairs to prevent the accidental entrance of water, are found on the sides of the thorax. To these the air is led by a singular passage. The side of the body which floats uppermost is keeled along the middle line. On each side of the keel and between it and the lateral edge runs a long row of elastic hairs, while a second and parallel row runs along the edge itself. These rows of hairs enclose a watertight covered way leading to the thorax, and along it the air is guided to the large thoracic spiracles."[1]

(2) All *Dytiscid* beetles are highly carnivorous, feeding on other animals and the juices of their victims.[*] On the inner side of the maxillæ of a *Dytiscid* beetle are ranged a row of stiff inward curving hairs. These, I think, serve as strainers, allowing an inflow of the juices into the mouth and keeping out foreign matter that would otherwise choke the insect. One of the aquatic *Diptera* larva (*Corethra*) has curious shaped mandibles which consist of five slightly curved teeth. The antenna of this larva is prehensible and serves not as an organ of touch but for the capture of prey such as minute crustaceans, etc. The captured prey is crushed by the mandibles and forced into the mouth not however to be swallowed. At the back of the mouth there are a number of stout hairs. These hairs allow no ingress, so that the body of the victim is digested in the mouth by the action of the salivary glands and only the juices flow into the stomach. Here again is another instance of a straining apparatus.

(3) It was shewn in the former part of this paper how certain hairs aid many aquatic insects in swimming. In the *Dytiscidæ* these are arranged mostly on the inward sides of the hind limbs in a close set fringe. On the outer sides are rows of stiff, sharp bristles. In some of the *Rhynchota* (*Notonecta*) both hind limbs are heavily fringed with fine hairs. On each side of the swimming organ

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[1] Miall " Aquatic Insects."

[*] I once watched a *Dytiscus* suck a large earthworm until nothing remained but the skin

of a gnat pupa[1] long stiff hairs project. These no doubt serve to give a greater impetus to the springing motion when swimming referred to above. A European species of aquatic *Hymenopterous* insect *Palynema natans* swims by means of its wings which are fringed with a row of fine hairs.[2]

(4) The hairs in the respiratory trumpets of a gnat pupa are seen when examined under a microscope to be extremely fine and close set, and from two to three hairs spring from each root.

The long hair-like filaments on the adult May flies (*Ephemera*) besides doubtless serving as organs of perception (*vide* Part I) are of use in at least two other ways. The flight of these insects is for the most part a sustained rising and falling. When rising the filaments are kept close together, but on the descent these are spread out in exactly the same manner that the feathers of a bird's tail are spread in flight. Might not these act like a parachute and break the insect's fall (they never *appear* to move the wings at all in descent) somewhat? I found that a captured May fly deprived of its filaments did not fly at all well, but of course it might have been injured in other ways besides. Each filament of a May fly is divided into a number of squares and each square is covered with minute thick set hairs resembling those found in the respiratory organs of a gnat pupa. Doubtless they serve the same function that is to protect the female from undue moisture during the period of egg deposition. Swammerdam found[3] that a species of May fly *Polymitarcys virgo*—which had fallen on a napkin spread over his knees that—" they could only rise into the air with the help of their long tail filaments which gave a momentary support to the body."

(5) Hairs that act as organs of preception, see my remarks on *Ephemera* in the first part of this paper.

Regarding the economic uses of aquatic insects I find that the vast clouds of mosquitoes and May flies seen over the African lakes are compressed into cakes for food by the Africans and dried in the sun. (Theobald.)

A few hints regarding the preparation of insects for the microscope taken from Messrs. Cross and Cole's "Modern Microscopy" may be of use.

Insects should be killed with chloroform. They are then to be placed in methylated spirit, in which they may remain until required for mounting.

To prepare a whole insect for mounting with pressure in Canada Balsam.

(1) Transfer from methylated spirit to water, and let it soak for three or four hours to remove spirit.

(2) Place in liquor potassæ[4] 10 per cent. of caustic potash in distilled water until soft. Some specimens will only require a few hours in the potash, others need days, and some even weeks to soften. In all cases they must be

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[1] The term *nymph* here is often employed.

[2] Lubbock *Linn Trans*. Vol. xxiv, p. 135 (1863).

[3] *Biblia Naturæ.*

[4] Any chemist can supply the ingredients mentioned here.

carefully watched and the action of the potash tested. This can be ascertained by pressing on the thorax or chest of the insect with some blunt instrument such as the head of a pair of curved-pointed forceps.

(3) When soft enough, pour away the potash and add water, which must be changed several times until all the potash is washed away.

(4) Pour away the water and add concentrated acetic acid, and soak for twelve hours, or until it is convenient to go on with the work.

(5) Transfer from acetic acid to water, and soak for about half an hour; then place in a shallow saucer full of water, and with the aid of a needle and a camel's hair brush spread out the wings, legs, etc. Now take a slide and place it in the water under the insect, lift the slide up carefully so that the insect may be stranded on the surface of the slide with all its parts expanded. Drain off the excess of water, and lay the slide down on a piece of white paper, and with the aid of needles or brushes carefully place all the limbs, wings, antennæ, etc., in their natural positions. Now put a narrow slip of paper on each side of the insect, and carefully lay another slide over it, press it down until the insect is squeezed quite flat, tie the two slides together with a piece of twine, and place them in a jar of methylated spirit for at least twelve hours, or until required.

(6) Remove the glasses from the spirit, carefully separate them, and with a soft camel's hair brush push the insects off the glass into a saucer of spirit.

(7) Take the insect up on a lifter, and float it on to the surface of a small saucer of clove oil, and allow it to soak until perfectly clear.

(8) Remove from clove oil and place in turpentine for a few minutes.

(9) Mount in Canada balsam thus :—

(*a*) Clean a cover-glass, moisten the surface of a slide with the breath, apply the cover-glass to it, and make sure that it adheres. (*b*) place a few drops of balsam on the cover-glass. (*c*) Warm a slide over a spirit lamp and apply a drop of balsam to that on the cover-glass ; take it up with a pair of forceps, and bring the drop of fluid balsam in contact with the centre of the slide which has been warm (care must be taken not to over-heat the specimen as it will curl up). Ease the cover down carefully, so that no air-bubbles may be enclosed, and press it down with the point of the forceps until the specimen lies quite flat and the excess of balsam is squeezed out. Allow the slide to cool, and the excess of balsam may then be washed away with spirit and a rag

To mount an insect in glycerine without pressure :—

Many small, soft insects and their larvæ may be mounted in glycerine while fresh. The larger and harder kinds must be soaked in potash to render them transparent. Make a cell of the required size, and fasten it to a slide with black shellac cement. Apply a coat of cement to the upper side of the cell, and allow it to nearly dry. Fill the cell with glycerine and put the insect into it ; spread out the wings, legs, etc. Clean and warm a cover-glass, and apply it to the edge of the cell ; press down, and be sure that it adheres to the cement all round. Wash away the excess of glycerine with some water, and dry the side with a soft cloth. When quite dry, apply a ring of cement, and when this has dried, add another coat of black shellac cement. The processes above refer to the study of the external parts of insects; all the soft tissues and internal organs will, of course, have been destroyed by the potash. Soft internal organs must be dissected out of the specimen under water

MISCELLANEOUS NOTES.

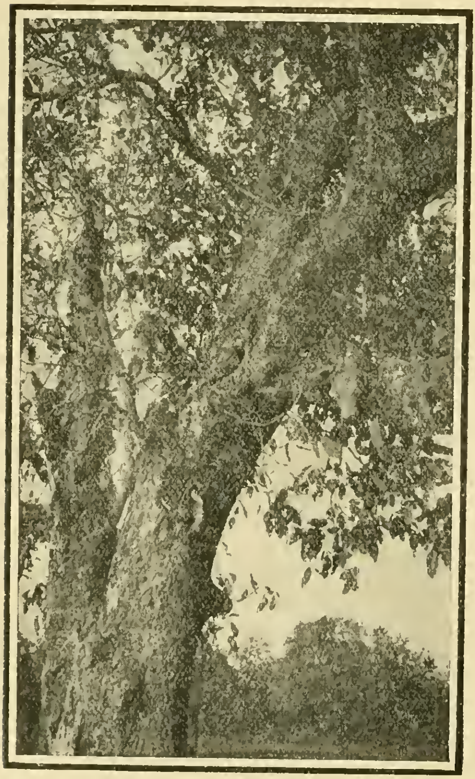
No. I.—A WHITE TIGRESS IN ORISSA.

In the *Indian Forester* for May Mr. Bavis Singh, Forest Officer, Dhenkanal, Orissa, records the shooting of a white tigress in the Mulin Sub-Division Forest of the Dhenkanal State, Orissa.

He describes the colour of the animal as follows :—"The ground colour was pure white and the stripes were of a deep reddish black colour." The tigress was shot over a buffalo kill and was in good condition not showing any signs of disease.

There are several previous records of white tigers. In *Wild Sports of Burma and Assam*, Col. F. T. Pollock writes :—"Occasionally white tigers are met with. I saw a magnificent skin of one at Edwin Wards in Wimpole Street, and Mr. Shadwall, Assistant Commissioner in Cossyah and Jynteah hills, also had two skins quite white."

Writing in 1907 Mr. Lydekker in the *Game Animals of India* mentions five white tiger skins as follows :—"A white tiger was exhibited alive at Exeter Change about 1820; a second was killed at Poona about 1892; in March 1899 a white tiger was shot in Upper Assam and the skin sent to Calcutta, where a fourth specimen was received about the same time. The Maharaja of Kuch-Behar also possesses a white tiger-skin."



No. II.—PANTHERS TAKING THEIR "KILL" UP TREES.

A short time ago some notes were published in the Journal about this habit and probably the enclosed photograph will be of interest.

The calf—head and neck one side of a fork in the trunk of the tree and hind legs and tail on the other—is seen to be well hung up some 12 or 14 feet from the ground. On the trunk the scratches made by the panther's claws can be quite distinctly seen.

The calf was a " tie-up " made by my brother. R. M. Bedon, of Nagpur, who also took the photograph. The occurrence took place on March 31st of this year at a village called Muwala, in the Balaghat District of the Central Provinces.

COLERIDGE BEADON.

NANDYAL, R.S., M.S.-M., 1st July 1909.

No. III.—THE CALL OF THE SLOTH BEAR.

I wonder if any of the readers of the Journal have ever heard the call of the Sloth Bear (*Melursus ursinus*). I have seen no mention of this call in any book, sporting or scientific, and Blandford, in *The Fauna of British India* boldly states :—" The Indian bears are quite silent animals, as a rule, and have no call for each other." A solitary experience of mine proves the contrary and the many sporting friends to whom I have made mention of it consider it of sufficient interest to warrant my sending you a note thereon.

Some eight years ago, during the hot weather months, I was enjoying a few days' shooting in the Jungles of the Indur District of the Hyderabad Dominions. One morning I saw a panther on some rocks not far from my camp. On seeing me it glided away down amongst the boulders on which it had evidently been sunning itself. As there was every convenience on the spot I decided to tie up a goat that evening near the rocks and sit up over it. This was all arranged, and late in the afternoon I took up my post in a neighbouring tree. I took a light repast with me and, as the moon was at the full, I decided to sit up all night. No panther came to the goat which was an unusually quiet beast and made no noise at all which would attract attention. Towards the early hours of the morning I heard in the distance, fully half a mile away I estimated, a beautiful long drawn note which was unmistakably that of a sloth bear. This call struck a cord in another bear which unknown to myself, was close to my tree. He immediately commenced whimpering and shuffled off towards the rocks. Occasionally, as though the desire to immediately answer the call was struggling with the desire to first reach the top of the rocks, he would stop, erect himself on his hind legs and commence a call in response. No finished response, however, was made until he reached the top of the rocks when he raised himself on his hind legs and with his nose pointing upwards he sent out a beautiful long mellow note in answer. This was repeated once or twice, and he would then listen for an answering call. On hearing this he would repeat his call. When this had been repeated three or four times, he shuffled off still whimpering evidently in the direction of his mate who was calling him up.

P. ROSCOE ALLEN.

BELLARY, 28*th May* 1909.

No. IV.—BROWN RAT (*MUS NORVEGICUS*) IN KHANDEISH.

In his paper on the "Races of Indian Rats," in the Records of the Indian Museum, Captain Lloyd remarks that, although many writers have stated that the brown rat is found inland, he doubts if it is found away from seaports, and in support of this view points out that no examples have been received at the Indian Museum during the recent inquiry.

In the Society's collection there is a brown rat which was obtained at Chalisgaon, Khandeish, and sent in alive to the Society on Jan. 13th, 1908.

N. B. KINNEAR.

BOMBAY, *October* 1909.

No. V.—A RECORD GREAT INDIAN RHINOCEROS (*RHINOCEROS UNICORNIS*).

A great Indian Rhinoceros was recorded in the pages of the *Englishman* for May 4th as having been shot in Assam by Mr. T. Briscome, carrying a horn of 24½ ins. and standing 6 feet 4 ins. at the shoulder. According to Lydekker the largest horn previously recorded was one of 24 ins. formerly in the possession of Dr. Jerdon, and in *Records of Big Game* one of 21½ ins. is mentioned as having been shot by Lord Curzon in Nepal.

In the above-mentioned book, Rowland Ward gives the height at shoulder of a rhino shot in Cooch-Behar and in possession of the Maharaja as 6 feet 6 ins., but there is no mention of one taller than 6 feet 4 ins. in the Maharaja's magnificent book '*Shooting in Cooch Behars, Duars and Assam.*'

No. VI.—HAUNTS OF THE INDIAN RHINOCEROS.

The following letter by a member of the Society appeared in the *Field* for July 24th, 1909.

SIR,—I have just seen an article "Oriental Big Game Notes," by Mr. R. Lydekker in the *Field* of May 29th last. His statement that the *Fauna of British India* (Part II., page 473) is incorrect in the supposition that the *Rhinoceros unicornis* is not found in India west of the Teesta river is certainly true. This rhinoceros is found in the Nepal Terai, in Morang, north of Purnea, on the Kosi, at Patharghatta, on the banks of the Bagmati north of Muzaffarpur, and as stated by Mr. Lydekker, it is even more numerous still farther to the west in the Chitwan and Naolpur valleys along the banks of the Gandak and the Rapti rivers.

In justice to His Highness the Maharaja of Nepal and the other Nepalese sportsmen, who took part in the great hunt referred to in the above article, I can, as an eye witness of what occurred, assure your readers that the account which Mr. Lydekker has heard is entirely garbled and misleading. The ground that was shot over in January and February 1907, was the tract orginally preserved by the Nepal Government for the shooting which they had hoped to give His Royal Highness the Prince of Wales in February 1906. This, unfortunately, had to be abandoned owing to a severe outbreak of cholera in the Maharaja's camp, which spread among the elephant drivers and rendered all question of a successful undertaking that year an impossibility. The total number of rhinos bagged was twenty-eight (fourteen males and fourteen females), and in addition six rhino calves were caught.

The Maharaja's object in trying to catch young rhinos was not, as might be inferred from your correspondent, either to sell them or to start a new form of sport (*i.e.*, rhinoceros racing) but to turn the young ones down for breeding purpose in the Eastern Terai, where these animals had become scarce through a disease which broke out some years ago. This, however, he was unable to do, as all six calves proved to be males.

In spite of the numbers of rhino which were killed in January 1907, the forests in Chitawan are still so full of them that no appreciable diminution in the stock has been made. The Maharaja was good enough to let me invite his Highness the Maharaja of Bikaner and another friend to shoot in February 1908, in the Naolpur valley bordering on Chitawan. My friends had no difficulty within two days in securing the four rhino for which I had asked the Nepal Durbar to limit the permit.

The following extract of a letter, dated May 25th, 1909, from Mr. F. W. Gordon-Canning, of the Pursa Factory, Champaran, who was fishing in the Rapti this year, will also corroborate what I say.

"My principal fun was going out on an elephant photographing rhinos. I "hope some will come out well. I took a lot, and came as near as 15 yards. "Once or twice we were in a tight place, but the rhinos did not make good "their charge. They are simply in swarms; I counted twenty within a mile "of my camp, and I did not go into the good ground. There were ten big ones "in a small piece of grass not more than 5 acres in extent."

I do not know to what young stag from Sikkim Mr. Lydekker refers, but the designation "Sikkim stag" for the shou (*Cervus affinis*) is, as Hodgson pointed out, incorrect, for the shou does not appear south of the Brahmaputra watershed. If the young stag from Sikkim is *Cervus affinis*, the probability is that he came from Thibet *via* Sikkim, and was not reared in Sikkim.

J. MANNERS-SMITH, Lieut.-Colonel,
British Resident in Nepal.

No. VII.—"THE MEASUREMENTS OF SOME OF THE HORNS IN THE COLLECTION OF THE BOMBAY NATURAL HISTORY SOCIETY."

It has been suggested to me that I should have stated in the above-named paper how the various measurements were taken, since there appears to be no recognised way which is accepted by all sportsmen and naturalists.

After consulting Ward's *Horn Measurement*, Burke's *Shikar Book* and various other books dealing with Indian sport and Natural History, the following measurements and the manner of taking them were decided on—

Length.—In Cattle, Sheep, Goats (except Markhor), Antelope (except Black

Buck), Gazelles, from the base over or round the outside curve to the tip. In Markkor the tape was run round the spirals, in Black Buck the measurement was taken straight and in Deer from the base of the bur along the outside curve to the tip of the main tine.

Circumference.—In all horns, except those of Deer, at the base. In Deer above the brow tine.

Widest inside.—In Cattle this measurement needs no explanation, but in Deer between the most distant points of the beam was the space measured.

Tip to tip.—There is no explanation necessary about this measurement, except in the Deer, where it was taken between the points to which the length was measured.

N. B. KINNEAR.

BOMBAY, *October* 1909.

No. VIII.—DO WILD ANIMALS DIE A NATURAL DEATH?

I was much interested in reading in the last number of the Society's Journal Col. Evans' Note on the question of "whether animals die a natural death"? An experience which I had in Chanda last Easter may perhaps be of interest to the members of our Society. I had gone out for the holidays in the hope of getting a shot at an old solitary Bull Bison, which lived about sixteen miles from Chanda. My shikari had gone out before and was tying up for a tiger and when I arrived I found that he had kills out in the direction in which this old bull lived, so I was forced the morning after I arrived to go out in another direction. I came up with a herd but did not get a shot. In the evening I went towards the nullah, where the old bull was said to live, and on my way there met the shikari who told me that he had just found the old bull lying dead in the nullah. I went along with him and sure enough there was a fine old bull lying dead in some longish grass near a pool in the nullah. He had evidently been dead only a few hours, as the flies had not got properly into him as yet and there were hundreds of vultures waiting on the trees for their feast. The Bison was in very good condition and had a fine pair of horns, very much worn away at the tips. I knew that foot and mouth disease was prevalent in these jungles at the time, and I examined his hoofs and mouth to see if there was any trace of disease. They were quite sound as far as I could make, and I do not think it is possible that he can have died of foot and mouth disease, as he would certainly not have been in such good condition. The same would I fancy be true of rinderpest, and in any case there was no rinderpest about at the time, as far as I could find out. I had not enough men with me to be able to turn him over, but there was no mark of a bullet in his skin when it was taken off. There were no marks of a struggle on the ground, so that he had evidently died quite a peaceful death. I am entirely at a loss to know to what cause death can have been due. Perhaps some member of our Society can solve the riddle? I was thus very nearly in a position to answer in the affirmative Mr. Betham's question :—" Has any one ever come across vultures feeding on a dead wild animal ?" The feast was spread for the vultures, but they had not been able to begin when I arrived on the scene.

R. A. WILSON, I.C.S.

MANDLA, 16th July 1909.

No. IX.—THE INDIAN THREE-TOED KINGFISHER (*CEYX TRIDACTYLA*) AT MATHERAN.

While walking down from Matheran with Mr. M. R. Jardine on July 7th, we put up a Three-toed Kingfisher, (*Ceyx tridactyla*) from a small stream by the road-side, about half-way down. This beautiful little Kingfisher appears to be of very local distribution in the Indian Peninsula and is confined to the west coast. Major Lloyd gives it in his Konkan List and Colonel Butler has recorded this species from below the Reversing Station at Khandalla and near Lanowli. The Rev. Dreckmann, S. J., tells me that he also met with this Kingfisher below the Khandalla Reversing Station about 1879.

N. B. KINNEAR.

BOMBAY. *October* 1909.

No. X.—YOUNG VULTURE IN THE SEA.

On Saturday May 8th, while sailing from Apollo Bunder to Hog Island, I noticed a bird in the water between Butcher Island and Pir Paon on the Trombay shore, probably two miles from the nearest point on the main land and one mile from Butcher Island. It was then about 5 P. M., and the tide had been ebbing for two hours. On getting closer, I found the bird was a vulture, apparently a young bird, but full grown or nearly so. Its wings were under water and only the neck above water, and the bird seemed quite incapable of rising or using its wings. Next day a fresh wind blew all the forenoon and gradually increased in force, and by 4 P. M. the water was somewhat rough. I was, therefore, surprised when passing close to the N. W. of Elephanta to see what was presumably the same bird flapping along still in the water and unable to raise itself completely, but managing to struggle slowly towards the shore of Elephanta by splashing its wings. I was unable to see what happened eventually, but as the bird was then only 100 yards or so from shore and was being helped by the tide, it presumably managed to get safely to land.

C. A. WORDSWORTH.

BOMBAY, 10th *May* 1909.

No. XI.—COMMON SNIPE (*GALLINAGO CŒLESTIS*) IN TRAVANCORE IN APRIL.

On the 21st April I shot three couple of snipe round a backwater at Quilon. I am interested to know if it is common for a few snipe to remain all through the hot weather in the south and why ? ! and if they breed here. The month of March is considered the most trying, so that they had survived the worst. I turned up 15 or 16, but there must be more in other places near.

G. W. GILES.

MADRAS, 25*th July* 1909.

No. XII.—PINTAIL (*DAFILA ACUTA*) IN BALTISTAN IN JULY.

On July 2nd I was encamped on the Shingo River which flows across the Deosai Plateau, Baltistan. At about 8 p m. I was surprised to see a fine drake Pintail in full plumage fly swiftly overhead up stream to a small marsh near the river Is this not rather far south for this duck to breed ? as I suppose it must be, here at this time of the year. My shikari, who also saw it, tells me he has often seen duck (though of course he does not know the species) on and about the rivers and small jhils of this district, *viz.*, Shemoskith Plains and Deosai Plateau at this time and earlier.

W. M. LOGAN HOME, LT.,
112th Infantry.

BORZIL, ON GILGIT ROAD, 6*th July* 1909.

No. XIII.—DUCK SHOOTING IN RAJPUTANA.

The famous Bharatpur Jhil is about 2½ miles in length and is situated in the middle of the forest preserve near the City of Bharatpur. It is filled at the end of the rains by a canal from a large irrigation tank, and being very shallow and covered with grass ferns and excellent feeding ground for duck. Usually it is quite dry by the end of March, but this year White-eyed Pochard and Blue-wing Teal were shot there as late as the 12th April.

This year the birds have been usually abundant. The first arrivals noticed were Blue-winged Teal on the 15th August. By the middle of September very large flights of these Teal were to be seen on the Jhil. No shooting, however, was allowed till the 30th November, and by this time the Blue-wing had disappeared being replaced by the Common Teal. In the big shoots in November, December and January very few Blue-wing Teal were killed. They re-appeared in considerable numbers in February, and as noted above were shot in April.

The following notes of some of the bags obtained during the past cold weather on this Jhil may prove of interest :—

30th November 1908	 2,237	(33 guns)
12th December „	 1,085	(16 „)
19th February 1909	 603	(11 „)
2nd March „	 582	(12 „)

The bag at the first shoot was a record for the Jhil both as regards total and verage per gun, the former recording only 1970.

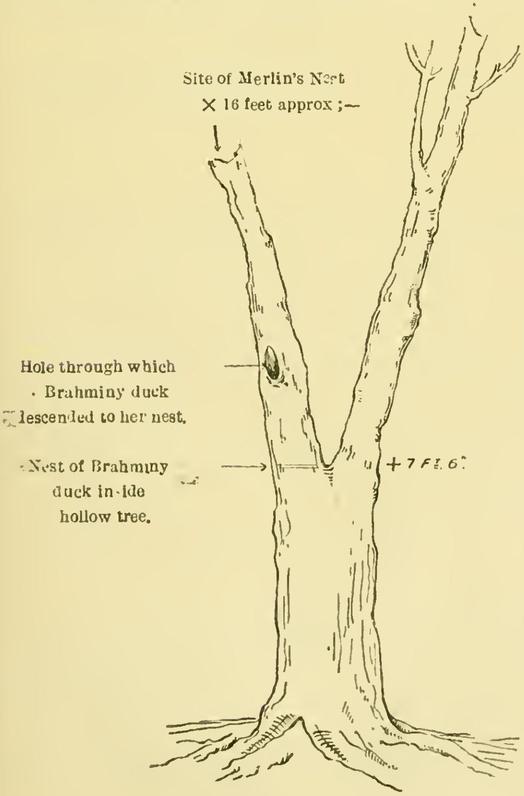
The guns were placed behind bushes on bunds and mounds specially constructed and beaters wade in to flush the birds. No regular register of the bags have hitherto been kept, but this year the following geese and duck were noticed in the bag :—Greylag, Gadwall Shoveller, Pochard, Widgeon, Red-crested Pochard, Tufted Pochard. Brahminy Duck Spot-bill, Nukta, White-eyed, Pochard, Marble Duck (only one shot), Common Teal, Blue-winged Teal and Cotton Teal. A Pink-footed Goose was shot, but was not seen by the writer.

The bulk of the bag at the shoots consists of Common Teal, White-eyed Pochard, Gadwall and Shoveller. Very large flocks of Pintail frequent this Jhil, but in accordance with their usual way habits do not afford the same chances as the duck named above.

L. IMPEY, LT.-COL.

BHARATPUR, 29*th April* 1909.

No. XIV.—THE NESTING OF THE BRAHMINY DUCK (*CASARCA RUTILA*).



Site of Merlin's Nest
× 16 feet approx ;—
Hole through which Brahminy duck descended to her nest.
Nest of Brahminy duck inside hollow tree.
+ 7 ft. 6"

Captain A. R. B. Shuttleworth has sent me the following regarding the nesting of the Brahminy Duck in Chinese Turkestan. As it will doubtless prove of interest to a great many of our readers, I send it for publication, together with a sketch taken on the spot. Writing from Camp Kizil Bui, C, Turkestan, 19th April 1909, he says :—"I was after tiger (woolly tiger) one day, and as I was sitting over a kill, I noticed, to my intense surprise, a couple of Brahminy come and settle on a tree quite close to me. I had no idea these birds ever settled on trees, as I have never seen them do so in India. My surprise was heightened when I saw one of them go into a hole in the tree. Later on I found a newly-made nest in this tree, although I was too early for the eggs. Yesterday while riding from the last Camp to this, a pair of Brahminy flew past me, flying low and one left the other and flew to an old poplar quite close and disappeared into a hole. This is the 2nd time I have seen the Brahminy do this. I got off my pony, climbed the old tree myself, and out flew the old bird almost into my face. I looked down the hole but could see nothing; I lit a match and put it down as far as I could and discovered there were 7 eggs. Unfortunately I could not reach them. I sent to the nearest village and got an axe, and after making a hole in the side of the tree, got out all 7 eggs. The first blow of the axe disturbed a merlin, which was sitting on its nest in a sort of declivity at the top of the same trunk, which contained the hole in which the Brahminy had her nest. The merlin had sat there, unknown to me, all the time I was fooling and trying to get at the Brahminy's eggs. I drew a rough sketch of the old tree on the spot, which will show you the position of the two nests. The merlin's nest contained two red eggs which I took. I think it is a curious fact that these two widely different birds should have had their nests on the same branch of the tree. There is no water within 8 miles of this tree, and that is curious I think. The drake Brahminy kept on flying round the tree making a fiendish noise, but the hen made herself scarce."

R. M. BETHAM, LIEUT.-COL.,
The 101st Grenadiers.

MHOW, *30th May* 1909.

No. XV.—STRANGE BEHAVIOUR OF CERTAIN BIRDS WHEN IN POSSESSION OF STRONG SMELLING INSECTS.

During the last few years I have repeatedly noticed that certain birds, notably babblers, in confinement, go through extraordinary antics when presented with strong smelling insects, *e.g.*, bugs (Hemiptera), which when irritated emit a powerfully smelling secretion in self-defence.

If, for instance, a bug of the above kind be offered to a laughing thrush (I have experimented with *Trochalopterum erythrocephalum* and *nigrimentum*; also *Dryonastes cærulatus*) it will seize it in its beak and make repeated efforts to press it against the underside of its tail feathers, near their base.

In order to do this it is obliged to bend round its head and to bring its tail forward.

This it does with considerable energy, so much so that I have seen the bird lose its balance and fall over, quite a ludicrous performance.

After this has been going on for a minute or so, the bird gradually relaxes its efforts and eventually swallows the insect.

The above described behaviour is not, however, I believe, confined to the laughing thrushes. I am almost certain I observed it also in the case of the Andamanese Tree-pie (*Dendrocitta baylei*) in the Andamans.

The habit is therefore evidently a widespread one, the origin and meaning of which however I am quite at a loss to explain. It would be interesting to know if others have observed this strange habit, and if so in the case of what kinds, and also if they can suggest a reason for such behaviour.

B. B. OSMASTON.

NAINI TAL, *June* 1909.

No. XVI.—THE SUPPLY OF WATER TO YOUNG BIRDS IN THE NEST.

I do not know that any one has ever recorded an observation to the effect that parent birds supply water to their young in the nest. Mr. Dewar on pages 227-228 of his interesting book "Birds of the Plains" discusses this question at some length.

While thinking it not improbable that birds should store water in their crops for a short time and "bring it up" for the benefit of their young, he points out that it would be a very difficult process to detect.

A few days ago a particularly favourable opportunity was afforded me of observing the feeding of young birds in the nest.

A pair of white-eyes (*Zosterops palpebrosa*) had constructed their nest in a creeper in the front of the verandah of the Rest-house I was stopping in, and the nest was so placed that I could watch the feeding of the half fledged young from a distance of about 4 feet in the verandah. On one occasion I observed one of the parent birds place rather a large insect into the wide open mouth of one of the young, which in spite of many efforts appeared to be unable to swallow it. The other parent who was watching operations from above seemed to grasp the situation at once, for he or she bent down and put a small drop of liquid into the widely-gaping mouth.

This process of giving small drops of liquid was repeated in front of me quite four or five times, and I was so close that there could be no mistake. Eventually the insect became softer and more manageable and the little bird's efforts were crowned with success.

This seems to prove that some birds at any rate supply water to their young in the nest when they appear to want it.

B. B. OSMASTON.

NAINI TAL, *June* 1909.

No. XVII.—BIRD NOTES FROM DUNGA GALI.

34. A loud and pretty double note of The Green-backed Tit (*Parus monticola*) heard this year was like the word "Wheat-ear," twice repeated. The note is an uncommon one and was evidently used by one of a pair nesting hard by.

204. In addition to its characteristic note of a very high-pitched and quickly repeated "Ting," "Ting," "Ting," "Ting." The Black-headed Sibia (*Lioptila*

capistrata) has an alarm note like the Thrushes (*Merula*) only more rapidly repeated and not so loud.

505. The note used by the Dark-grey Cuckoo-shrike (*Campophaga melanoschista*) in the breeding season, I can now confirm, is as described in this Journal in "Bird Notes from Murree and The Galis," Vol. XIX. No. 1. It also sometimes utters a small magpie-like chatter. The nest is such a tiny cup, or rather saucer, that the sitting bird almost entirely conceals it.

698. The song of The Small-billed Mountain Thrush (*Oreocincla dauma*) is loud and rather like that of The Missel Thrush, but more disconnected, a long pause coming between each note. It is something as follows:—"Chirrup," "Chewee," "Chüeü," "Wiow," "We ep," "Chirrol," "Chup," "Chewee," "Wiop,".

741. To illustrate how highly insectivorous even the most typical of the finch family become in the breeding season, I may mention the case of a female Black and yellow Grosbeak (*Pycnorhampus icteroides*) which on the 5th of July I saw devouring a fair-sized slug!

744. The spotted-winged Grosbeak, *Mycerobas melanoxanthus*, utters at times a variety of parrot like note in addition to the note described (op cit). Possibly in captivity it would surpass many of the paroquets in talking capacity. The distant sound of the call note or note of communication, mostly used when flying, can be fairly well represented by shaking an ordinary match box containing a few matches. This Grosbeak is shy and difficult to observe as it keeps to the tops of high trees and does not move about the branches much. Even when in some numbers its presence can rarely be detected except by the loud oriole-like song-note of the male already described. When paired and nesting it is still more wary.

The colour of the lower parts of the male is of a paler yellow than in the last species. In flight also it is more rapid and, as a rule, flies higher.

1072.—On the 13th July I came across near Changla Gali at about 7,600 feet a breeding colony of Blyth's White-rumped swifts (*Cypselus leuconyx.*) A flock of swifts playing about a cliff face attracted my attention. On nearer approach the parent birds flying in with food amid a continuous tittering clamour of nestlings at once revealed the nest-holes.

The kind of cliff apparently normally selected for nesting sites by this species is one where there is a rock strata with a downward slant towards the cliff face, the nests being built in horizontal interstices between the strata where the upper projects over the lower. Vertical fissures do not appear to be considered suitable sites.

1105. A female Himalayan Cuckoo (*Cuculus saturatus,*) which was shot, evidently in the attempt to lay an egg, was brought to me on the 7th of June. I took the fragments of the egg (which was broken by the fall) from the oviduct. They were pure white and without any markings whatever.

The bird most commonly victimised by this Cuckoo in these hills is "The Large-crowned Willow Warbler (*Acanthopueusta occipitalis*).

1141. On the 18th of May, I heard in a tree overhead the kissing noise which the young of the Slatey-headed Paroquet (*Palæornis schisticeps*) make when being fed by their parents, and, thinking it early for young to be hatched, looked up and saw a male feeding an adult female, his mate, on a branch outside the nest-hole in which she was evidently hatching off a brood. When the male had given her all he could regurgitate, she dived into the nest-hole again to resume her sitting. It would be interesting to know if the female of this species always comes out of the nest-hole to be fed.

1175. The note of the Spotted Himalayan Scops Owl (*Scops spilocephalus*) is as described in the "Fauna", the pitch being a treble F but sometimes E. The hoot is only heard after dark. This little owl is sometimes easily attracted to a tree over one's head by imitating its call.

1186. As regards cadence the call of The Collared Pigmy Owlet, *Glaucidium brodiei* is as described in "The Fauna," that is "Hoot—Hoothoot—Hoot", but the timbre of the note is remarkably like that "The Copper-Smith," (*Xantholæma hæmatocephala*). The pitch is C lower than that of the last species. A monosyllabic "hoot" is given by the young fledgelings. I have never heard this Owlet's note after dark

An excellent method of attracting small birds to the trees around one is to imitate the hoot of this little owl. Tits, Willow Warblers, Verditer, Flycatchers, and Minivets especially will, if in the vicinity, always quickly appear and use their best "Bengali" on their supposed enemy, giving one a splendid opportunity to study them at close quarters.

1217. On the 13th June I saw a Crested-Serpent Eagle (*Spilornis cheela*) being badly harried by a pair of Jungle Crows (*Corvus macrorhynchus*). When first I saw the Eagle it was on the ground with the crows in the trees above. Whenever it attempted to get away, the crows kept above and worried it badly, its loud kite-like cry being constantly uttered in its distress. I did not see the end of the fray, but it appeared to be a one-sided affair for the unfortunate Eagle.

1260. The habit of the Hobby (*Falco subbuteo*) of hawking in flocks for flying insects high in the air after the manner of swifts is not noticed in "The Fauna" but is mentioned by Murray in his "Indian Birds." This habit is, I think, characteristic of The Hobby, and I saw it constantly executed by a flock of 8 or 10 of these splendid little falcons which frequented a certain hill-side in Dunga Gali for several days.

One of the flock, an adult ♀, was knocked over and shown me by a friend. No easy shot at the pace they travelled.

Frequent and severe storms throughout May and June interfered to some extent with the breeding season of 1909 in the Galis, and genera such as the Sibias, Drongos, Minivets, Cuckoo-shrikes, Grosbeaks and others which nest in open and exposed situations suffered considerably.

H. A. F. MAGRATH, MAJOR.

DUNGA GALI, 11*th July* 1909.

No. XVIII.—NOTES ON A COLLECTION OF SNAKES FROM MATHERAN.

A collection of snakes made by Captain McPherson, I. M. S., at Matheran (2,500 feet) and presented to our Society, contains the following species :—

UROPELTIDÆ.

Silybura macrolepis.

One specimen of this species which is peculiar to the Western Ghats. The costals are 15 at a point two head-lengths behind the head, 15 in midbody, and 15 at a point two head-lengths before the vent. The ventrals and subcaudals 129+9. The ventrals are not twice the breadth of the last row as stated by Boulenger, the last row being two-thirds as broad as the ventrals.

COLUBRIDÆ.

Tropidonotus piscator.

Two small specimens, olivaceous chequered with small spots. (Variety *punctatus*, Wall).

Lycodon aulicus.

Four specimens, all variety *typica*. The ventrals and subcaudals of three are 206+66, 207+ ? (tail imperfect), and 208+61 (the first 4 entire).

Lycodon travancoricus.

Four specimens, all ♂. The ventrals and subcaudals are 192+ ?, 20272 , 198 + ?, and 196 + 75. The anal is entire in all. Three of these are quite typical in colouration, but the fourth is peculiar in that it appears to be uniform dark purplish brown. With the aid of a lens an indication of the normal yellow cross bar can be very dimly discerned. One specimen had a frog in the stomach.

Macropisthodon plumbicolor.

Three specimens, one quite young. The costals in all are in 25 rows at midbody, and 19 at a point two head-lengths before the anus. Two head-lengths behind the head they are 23 in two specimens, 25 in the third. The ventrals and subcaudals are 152+45, 163+40, and 155+43. In one nearly adult specimen the black bands across the body, and the yellow chevron edged with black on the nape were unusually conspicuous for a specimen of this growth

Zamenis mucosus.

One half-grown specimen, light in colour, abundantly variegated with black in the hinder part.

Coluber helena.

Two examples. One is an enormous specimen of its kind, measuring 4 feet 11 inches. The costals are 23 two head-lengths behind the head, 25 in midbody, and 19 two head-lengths before the anus. The ventrals and subcaudals are 142 + 79, and 228 + 86. I notice that in all specimens from the Hills of Western Indian Travancore to Western Ghats the bands on the anterior part of the body are connected by festoons of black spots on the ventrals.

These festoons are not seen in Himalayan examples, nor did I find them in a specimen recently received from Udaipur.

Dendrelaphis tristis.

Two specimens of this rather uncommon snake which, however, has been previously recorded from Matheran. The head and forebody only of one specimen is sent. The ventrals and subcaudals of the perfect example are 182 + 129, and the anal divided.

Dryophis mycterizans.

Three examples all young.

Dipsadomorphus forsteni.

One fairly large adult. The costals are 25 two head-lengths behind the the head, 27 in midbody, and 17 becoming 15 at a point, two head-lengths before the anus. The body is too damaged to count the ventrals. The subcaudals are 106. The supralabials are ten, and the 4th, 5th and 6th touch the eye. There are three series of black spots which are broader than long, the median alternating with the lateral series. These markings are extremely like those in the species *quincunciatus* I recently described from Assam.

Captain McPherson says he also collected 3 kraits *B. cœruleus*, and 2 pit vipers *Lachesis gramineus*.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, 25*th April* 1909.

No. XIX.—NOTES ON A COLLECTION OF SNAKES MADE IN BAXA DOOARS.

Last year, thanks to the kindness of Captain K. L. W. Mackenzie, I acquired a collection of snakes made by him at Baxa Dooars (1,200 to 1,500 ft.), which includes the following species :—

TYPHLOPIDÆ.

Typhlops diardi.

One adult specimen. The costal rows in midbody are 26.

COLUBRIDÆ.

Polyodontophis collaris.

One typical adult.

Tropidonotus piscator.

One specimen of variety *quincunciatus* with very large spots

Tropidonotus subminiatus.

One adult, typical in every way.

Tropidonotus himalayanus.

One adult.

Pseudoxenodon macrops.

Two specimens.

Lycodon aulicus.

One example of variety D of Boulenger's Catalogue (I, p. 353). The anterior labials are mottled with brown.

Coluber radiatus.

One adult, one quite young marked just like the adult. The ventrals and subcaudals of the latter 246+93.

Simotes albocinctus.

Four examples of variety *typica* (Cantor).

Chrysopelea ornata.

One fine specimen of variety F of Boulenger's Catalogue (III, p. 198). The costal rows are 17 anteriorly and in midbody, 13 at a point two head-lengths before the anus. The ventrals are 214, the last being divided like the anal. Tail imperfect.

Dipsadomorphus hexagonotus.

One specimen quite typical.

Psammodynastes pulverulentus.

One adult and one young. The adult blackish, with a conspicuous series of rufous spots on each side of the back. The young one is striped longitudinally. A dark stripe involves the upper half of the ultimate row, and two-and-a-half rows above, then a light stripe involves the upper half of the 4th, the whole of the 5th and the lower half of the 6th rows. A median dorsal stripe is rather obscure in definition. There are also indistinct cross bars. An irregular series of bright ochre spots adorn the flanks, and the belly is streaked and spotted with ochre anteriorly.

VIPERIDÆ.

Lachesis gramineus.

Four examples. The costals are 21 in the anterior and middle parts of the body, 15 at a point two heads-lengths before the anus. One adult is yellowish-green with no flank-line, another bright green with an interrupted line in the flanks formed of white dashes on the upper borders of the scales of the last row. One young one has a pale rather indistinct flank line, and another a flank line of liver and white.

Captain Mackenzie tells me that one of the sepoys of the 62nd Punjabis encountered a hamadryad one day when out shooting. The man was stalking a khakar (*Cervulus muntjac*). Unknown to him the snake was close to the deer, and when he shot the latter, the snake glided swiftly straight at him, and he shot it. It measured 9 feet 11½ inches, and contained a large monitor lizard (probably *Varanus bengalensis*) measuring 3 feet 9 inches. It was brownish-black in colour with faint black rings in the anterior 5 feet, and yellowish-white bands in the rest of the body, not conspicuous until the scales were separated. The throat was yellowish white, and the head shields margined with black.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, 24*th June* 1909.

No. XX.—A SNAKE FLIRTATION.

When inspecting forest in the neighbourhood of Ghodbunder (Thana District) at the beginning of June last, my attention was attracted to a wriggling mass of snake on the cleared boundary line. On approaching cautiously I found two dhamans (*Z. mucosus*), one apparently about 8 feet long and the other perhaps a foot shorter, coiled together from the tail ends up to within a foot or so of their heads. Natives with me declared that the smaller snake, which was coiled round the other, was a male and that the larger snake was a female. Beyond that the smaller snake was somewhat darker in colour than the other, I could see no difference in them. The smaller snake was slowly working his coils throughout up and down the other, and both snakes were keeping their heads and free part of their length erect and alternately twining their free part round each other and approaching each other's heads in a " billing and cooing" manner. At the same time they were travelling very slowly in a forward direction. The snakes seemed absolutely careless or oblivious of our presence, though we stood within a couple of yards of them, and my small terrier went even closer and sniffed at them. I watched them for three or four minutes, moving forward as they moved, until the larger snake seemed suddenly to become aware of on-lookers, when she rapidly disengaged herself and glided away into the jungle on my right. The smaller snake stayed for a few seconds with a somewhat dazed manner and then seemed to scent danger and hastily slid into a small bush a few yards to the left, where I left him undisturbed. This behaviour of the snakes was new to me, and I could only presume that it was a preliminary flirtation prior to more serious matrimonial intentions.

G. P. MILLETT.

BANDRA, BOMBAY, 20*th July* 1909.

No. XXI.—CORRECTION OF NOMENCLATURE.

I am sorry to notice (though snakes are not in my department) that Major Wall has yielded to Mr. Venning's well-meant but entirely mistaken correction of the gender of *Lygosoma*. Although it is true that the Greek word *soma* is neuter, the laws of Greek orthography make it quite impossible for *Lygosoma* to be neuter likewise ; it can be nothing but the feminine of an adjective *Lygosomos*, and as feminine it must rank accordingly. Some twelve years ago or thereabouts (I have not the exact reference at hand), I wrote a short explanation of this in " Nature " ; not only did no one offer any opposition, but Dr. Murray of Oxford wrote in confirmation, remarking " Mr. Meyrick is, as might have been expected, perfectly right."

E. MEYRICK, B.A., F.R.S.

MARLBOROUGH, WILTS, ENGLAND, 5*th July* 1909.

No. XXII.—SOME NOTES ON THE CAPTURE OF BUTTERFLIES.

That there are certain specific times, when the energies of the butterfly collectors are more likely to be rewarded than at others, is well-known and accepted by all entomologists. These periods vary more or less according to the habits and habitat of species ; but, generally, it is between the hours of 10 and 12 noon, on a bright sunny morning, that more specimens are seen than at any other time. I have, however, in the course of rambles on the hills of Eastern Bengal and Assam, observed and profited by the observation, that though there are no butterflies actually on the wing on a dull overcast day, with perhaps even a fine drizzle coming down, it is possible to capture many a fine specimen with comparatively little trouble on such inauspicious occasions. The *modus operandi* is simply to beat up or otherwise disturb any likely haunts such as shrubs and leafy trees. The butterfly, if there be one, will thereupon make a hasty exit, and if not then caught will be seen to immediately seek shelter in the nearest promising shrub or tree, where the same manœuvre can be repeated till finally captured.

It seems to me that butterflies thus caught are almost invariably in perfect condition, are less active, and thus more easily secured, and last but by no means least open out to our new fields for exploitation.

H. JAMES.

LAHORE DISTRICT, 15*th July* 1909.

NO. XXIII—THE EARLY STAGES OF THE HAWK MOTH (*THERETRA PALLIGOSTA*.)

Habitat.—Western to North-East India and Burma and Ceylon to Hongkong.

Localities.—Karwar, Sikhim, Silhet, Khasia, Jaintia Hills, Assam, E. Pegu and Pugyi, Burma, Ceylon.

Elevation (vertical range) up to 7,000 ft.

Time of appearance.—May to July and October.

Occurrence.—Rare.

Expanse.— ♂ 60-82 mm. ♀ 82 mm.

Larva in first stages, ground colour from pale green to sap-green in general appearance much resembling the larva of *Rhyncholaba acteus* both in shape and colour and also in markings, the oval ocellus on the fourth segment is coloured as follows:—In the first stages centre black, then a ring of pale blue, then green, then yellow, then pale blue again and finally circled by a black ring ; the following ocelli, which are about half the size are pale blue and yellow ringed with black, a dark dorsal line throughout its entire length, horn yellow with tip black and very long ; legs and claspers pale pinkish yellow, head green. The sap-green form, which subsequently changes to chocolate and then again to green has the ocellus centred black, then ringed pale blue, dark green, pale yellow, pale blue and then black, the succeeding occelli are pale blue and white with black rings ; head, horn, legs and claspers dull yellow.

The adult larva has the ocellus on 4th segment black centre ringed with blue and green, pale yellow, then mauve, and finally circled with black, the other ocelli which are not quite equal in shape, are centered with pale yellow and mauve and ringed with black, horn of medium length dull pink, legs dull pink, claspers green, from 5th to 10th segments it is profusely speckled with black and grey, dark dorsal line to 4th segment, spiracles pink with darker centres.

Length—100 mm.

Time of appearance.—May to July.

Food-plants.—*Aporosa villosa* (Euphorbiaceæ).

Pupa very dark, almost black on the head and wing cases, a pale mesial band on the ventral surface of the abdomen, variegated with black and brown of various shades tongue case and legs very prominent, dorsal surface reddish in colour with a distinct dark mesial line from base of thorax to end of abdomen. Cremaster more or less flattened wedge shaped with two small bristles at the extreme tip.

Length.—40-60 mm.

Time of pupation.—Throughout the year.

Situation.—Under fallen leaves in slight depression on surface of the ground at or near roots of food-plant.

C. E. F. MANSON.

PUGYI, LOWER BURMA, 15*th June* 1909.

No. XXIV.—NEW LOCALITIES FOR RARE AND LITTLE KNOWN SPHINGIDÆ.

Occurrence of *Callambulyx poecilus* in Sikhim, and of *Chromis erotus* and *Macroglossum faro* in Burma.

It may interest collectors of Heterocera in India and Burma to know that I captured a specimen of *Callambulyx poecilus* (Roths) in Sikhim at an elevation of 6,000 ft. in May, and a specimen each of *Chromis erotus* (Cram.) and *Macroglossum faro* (Cram.) in Burma in August and October respectively.

C. E. F. MANSON.

MANDALAY, BURMA, 25*th June* 1909.

No. XXV.—NOTE ON THE PRESENCE OF THE COCCID GENUS *MARGARODES* IN INDIA.

Amongst a collection of Coccidæ recently received from the Indian Museum, Calcutta, I have found specimens of what is undoubtedly the male of a species of *Margarodes*, an interesting genus that hitherto has never been recorded from the Indian Region.

The females of this genus are subterranean insects, feeding upon the roots of plants and often attended by ants. They secret pearly shells which —in countries where the insect is common—are collected by the natives and strung into chains for personal ornaments. It is insects of this genus, also, that have probably given rise to the stories of living pearls that—when kept in a pill-box and fed with grains of rice—increase and multiply, giving birth to numerous small pearls. Are such tales current in India? If so, may I ask Members of the Society to interest themselves in the matter and send me specimens for identification and description

The male *Margarodes* is a two-winged insect, the expanded wings measuring about 8 mm. (approximately one-third of an inch). The wings are colourless and transparent, with the exception of a deep red thickened costal border. There are tufts of long silky white filaments arising from the upper surface of the abdomen. The specimens from the Calcutta Museum are labelled 'Jahada, Nepal, 14th November 1908".

E. ERNEST GREEN.

PERADENIYA, CEYLON, 29*th June* 1909.

No. XXVI.—TWO SPECIES OF "CHARA" FROM THE BOMBAY ISLAND.

Specimen No. I was collected on the 14th of November 1908, from a pool on the Vincent Road, Matunga, situated in the fields where rice is cultivated during the rains. The plant grew on the borders of the pool under water extending to knee-depth, entangled with the aquatic plant *Hydrilla verticillata* (*Serpicullа verticulata*—Roxb) which it resembles in general appearance, and was greatly interspersed with the filamentous Alga—*Œdogonium scutatum.* I found great difficulty in separating the Chara plant from these filaments of the *Œdogonium.* It appeared as if there was some commonsalism between these plants. The pool dries up in the hot weather during the months of April and May, so that it is difficult to say whether the Chara plant is an annual or a perennial plant. The plant is gritty and brittle on account of the deposition of carbonate of lime. The stem is stout and branched alternately. The internodes, when full grown, are about an inch in length. No adventitious rootlets were seen on the stem. Leaves are in whorls of 9, 10 or more. Each leaf is more than six-jointed and tapers singly at the end. The reproductive organs are borne upon the upper surface of the leaves, and at the joints of their basal half. The plant is monœcious, and fertilisation takes place during the night or very early in the morning. Both the organs are borne on the same node, the orange and globular antheridium being below the typical oogonium which is subtended by a few simple short-unjointed leaflets. The antheridium matures before the oogonium of the same node, and so the plant is protandrous.

Roxburgh in his "Flora of India" mentions some species of the genus Chara and describes one species, *Chara verticulata*, a native of India, including the genus Chara amongst the Flowering Plants which is unscientific. His *Chara verticulata*, however, has all the general characters of this specimen No. I., and I would therefore name it as *Chara verticulata.*

Specimen No. 2 was collected on the 26th December 1908 from another pool in the same locality but about 100 yards northwards of the first pool. The plant was growing in heaps on the boarders of the pool, and was more or less free from the filamentous Alga. It is interesting to observe that both the plants grow in pools about rice fields. The pool also dries up during the months of April and May. This species is not gritty and brittle, indicating absence of any deposit of carbonate of lime. The stem is thinner than that of specimen No. I, delicate in appearance and more frequently branched. The full-grown inter-nodes are comparatively very long and the leaves are shorter in length and less numerous in the whorl than in the Specimen No. I. The reproductive organs are borne on the upper surface of the leaves as in the first specimen. There were no antheridia on the specimen I collected. Possibly they had all discharged during the previous night or the plant is diœcious. This point requires confirmation. The Oogonia are similar to those of the first specimen.

The other species described by Roxburgh differ from this Specimen No. 2. Mr. Gregg in his "Text Book of Indian Botany" mentions a plant *Chara flacida* A. Braun, as being very common in tanks and jheels in Bengal. Either this is the same plant or a different species requires verification. If "flacida" is indicative of the soft nature of the plaint, I would provisionally name it *Chara flacida*.

VINAYAK NANABHAI HATE, B. Sc.

Wilson College, Bombay,
June 1909.

MARINE BIOLOGICAL LABORATORY
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REVIEW.

" BIRDS OF THE PLAINS."

Captain Fayrer has pointed out to us that the last paragraph of the above review is quite incorrect and he draws our attention to the title page where it is stated the "illustrations from photographs of living birds." We have shown this to the Reviewer who says that when criticising the illustrations he did not notice that they were from life and adds that enlarged photos are often apt to come out stiffly giving the appearance of a stuffed bird as for instance in the plate of the Bulbul.—Eds.

THE MAKING OF SPECIES

BY

Douglas Dewar & Frank Finn,
pp. 400. London, John Lane. 7s. 6d.

The interest taken by the public in Heredity and other biological problems is shown by the many works that have recently appeared in plain untechnical language, and in addition to the excellent books of Thompson and Bateson among others two members of our Society have made a further contribution.

We find however that much that is otherwise readable has been spoiled by the aggressive tone of the authors. On reading their preface one anticipates a campaign of iconoclasm calculated to stagger humanity.

"We fear," they say, " this book will come as a shock to many scientific men " whom they look upon as equal in bigotry with the old-time theologians. " The blight of dogma has seized hold of them. We are endeavouring to save biology in England from committing suicide, to save it from the hands of those into which it has fallen." " Zoological science stands in urgent need of constructive books on evolution. It has been our aim to produce a book of this description." After all this one is relieved to find that not only some of the old idols remain unshattered, but the authors have set up a new idol under the name of " The Biological Molecule," which our readers will find strictly after the image and likeness of the old idols " Biophor, Ultimate Biological Particle," "Physiological Unit," etc.

The authors delight in setting up images of straw or phantoms on which to exercise their destructive criticism. For instance, " A large *majority* of scientific men to-day hold the belief that *all or nearly all the colours* displayed by animals are of direct utility to them and therefore the direct result of natural selection." " These theories have assumed the rank of laws of nature. To dispute them would seem to be as futile as to assert that the earth is flat. To take exception to them would appear to be as ridiculous as to object to Mount Blanc. To dare to criticise them is heresy of the worst type." Our gallant authors "have dared to weigh these theories in the balance of observation and reasons." They have examined "these mighty images of gold and silver, and brass, and iron and found that there is much clay in the feet." They devote a "chapter to lifting the hem of the garment of sanctity that envelopes each of these images and so expose to view the clay that lies concealed."

These unfounded charges—the italics are ours—are followed by over a hundred pages of criticisms of the theories, of mimicry, cryptic, warning and other colorations which have been pushed by a few to such absurd lengths and have already been sufficiently dealt with by Kellog, Beddard and others.

The Wallace School have the theory thrust on them "that every infinitesimal variation has a survival value." Their account of Mendel's phenomena is strangely incomplete, of his "law," inaccurate. No mention is made of the proportion of recessive and dominant offspring arising from dominants in the third filial generation. Mendel's explanation or "Law" is said to be "The gamete or sex-cell of each individual crossed breaks up into its component parts T and D." A biological absurdity, most certainly never fathered by Mendel!

Mendel's very simple, almost obvious, explanation of the facts he observed was that the cross-bred offspring produced two kinds of gametes—one with the dominant, one with the recessive character. If these be produced in equal numbers and fertilisation be fortuitous we may expect 25 per cent. R to mate with R. gametes, 25 per cent. D to mate with D gametes, 50 per cent. D with R. But as the fertilised egg cell which has *either* of the gametes D, will produce the dominant character, the result will be that this 50 per cent. will exhibit the D character though really DR. Hence only the 25 per cent. pure R will show the recessive character, while 75 per cent. will show the D character. Of these 75 per cent. 25 per cent. will be pure D and in future generations all their offspring will show the D character, whereas the 50 per cent. DR. will as before produce 25 per cent. pure R, 25 per cent. pure D, 50 per cent. DR. showing the D character. This is precisely what occurs in the Mendelian phenomena. Another error of considerable importance is the statement regarding Mendel. "The results of his experiments were published in the Proceedings of the Natural History of Brunn in 1854." This would give Mendel's publication a priority of five years over Darwin's "Origin of Species." The fact is Mendel read his papers before the Society in 1865. They were published in 1866. Unimportant slips are calling the prickly pear *Euphorbia*, p. 274; the yellow and black banded krait *Bungarus cæruleus*, p. 217. Can the authors give more adequate authority than *on dit* for their statement concerning the *Ovis ammon* ram on page 120?

The authors inform us "*Most* English men of science believe that natural selection offers the key to every Zoological problem." They "are living in a fool's paradise." The fault in this deduction is that the premises are doubtful. "Another reason why Great Britain is losing her scientific supremacy is that too little attention is paid to the study of live animals. Morphology, or the science of dead animals, receives more than its due share of attention." "*We wish merely to insist upon the fact that the leaders of biological science must of necessity be those naturalists who go to the tropics* and other parts of the earth where nature can be studied under the most favourable conditions and those who conduct scientific breeding experiments." A charmingly naive assumption, which will be cordially endorsed by the members of our Society! Has India risen to a position of "scientific supremacy" with all her advantages for adopting these lines of research? We fear the present deplorable condition of biology in India is due to the almost total neglect of laboratory and dissecting room research. The morphology of the authors is but skin-deep to judge by the proportion of the book devoted to colour and superficial variations.

What progress are we to expect from the "systematists," such as the entomologist who in a few years will have invented over million species of insects? Nomenclature and classification are the be-all and the end-all of certain naturalists. To us it seems like learning the index of a book before reading its contents. Why is not work done by the graduates of our Indian Universities, our B. Sc's., and M.A's. with Honors in Biology? The reason is they do little practical work in the laboratory. Their learning is obtained from books and wax models.

Notwithstanding Darwin has described climate as "the most effective of all checks," the authors complain: "In our opinion Darwin did not lay nearly enough stress upon the importance of climate as a check on the increase of 'species.' Darwin failed to notice the potent effects of damp." The authors then proceed to give instances most of which are the results of parasites rather than of damp.

"Wet snout," which decimates rabbits in damp climates, is the result of an animal parasite. Camels, sheep, etc., are destroyed by flukes and other parasites in most climates, not by the actual damp itself. Pneumonia and malaria both popularly attributed to damp are due to the flourishing of a vegetable and animal parasite respectively.

Kay Robinson's statement "Fruits are more generally scented than flowers" is quoted with approval in support of an argument, that the scents of flowers are not an attraction to insects or birds. Are they serious in this? Have they considered the relative odours of the fruits and the flowers of the Pea, Rose, Hawthorne, Pink and other plants? The odour of fruits is distinctively functional in ensuring the dispersal of seeds in many cases, and is frequently associated with a strong testa or endocarp so that the animal who devours the outer succulent portion will not digest the seed. "Therefore, if we say that plants have scents for the purpose of attracting insects, we accuse all plants which have scented fruits of attempted suicide."

In the middle of the discussion of Mendel's theory Weissman's experiments with the pupæ of *Vanessa prorsa* and *V. levana* are quoted. We cannot perceive any relevance.

Bateson is claimed as of the "school to which we belong" steering "a course between the Scylla of use-inheritance and the Charybdis of the all-sufficiency of natural selection." We fear the open mind of Professor Bateson has yet to be satisfied with an undoubted instance of use-inheritance.

THE BIRDS OF BURMA.

By Major H. H. Harington, F.Z.S., M.B.O.U.

Rangoon, "Rangoon Gazette" Press, 1909.

The object with which this small brochure on Burmese Birds was written is given by the author in his Preface where he states that "the original articles which appeared in the *Rangoon Gazette* were written with a hope that they might be a slight help to those who take an interest in our common birds." The title of the book is hardly appropriate to its contents, and it would have been better had it been "Some Common Birds of Burma" or something equally unpretentious. It does not attempt to deal with *all* the birds of Burma, and the selection of those with which it does deal is somewhat arbitrary, and appears not to have depended so much on any thought-out system as on the author's own ideas, or, possibly, upon the sequence in which the original articles were written. Major Harington has endeavoured to place before his readers a rough sketch of many of the more common birds to be found in Burma, both Upper and Lower, and, rather than enter into long scientific descriptions, has given us what he considers a general idea of the appearance of each bird in life. From these word pictures, he hopes that observers may be able to *spot* the various birds to which their attention may be drawn. In some instances his descriptions are distinctly happy, and any one seeing for the first time the bird described by him should be able to recognize it. Thus the Bulbul with the "red seat to his trousers" cannot escape detection, and many other birds which have some dominant feature in their plumage have had this feature seized upon and brought vividly before the readers' eyes. On the other hand, Major Harington has not been so fortunate when he has attempted to draw a picture of the plainer, more insignificant birds, such as many of the sombre-coloured Babblers and Warblers. It would be impossible, we fear, for any one to say what bird is described in the following words.—"It is about four-and-a-half inches in length, with white tips to its tail feathers, its under-parts light-coloured" (The Rufous Fan Tail Warbler), or again "about 12 inches in length and large for its size. Its upper plumage is grey with black points, under-parts greyish white" (The Large Cuckoo Shrike). The notes on habits, nidifications, &c., are nearly always to the point, and, though brief, contain no little information; indeed in many cases the readers of these notes will find them of more use in identifying the bird than the actual descriptions which precede them. The author is evidently a close observer, and has generally recorded those points in a bird's habits which would attract the attention of those for whom the first part of this volume is written.

As regards the sequence in which the families are placed it would perhaps have been better to have adhered to that given in Oates' and Blanford's "Avifauna," as this is the work to which we are referred to by the author for further information. It is probably correct not to associate the "Crowtits" with the "Crows" as does Oates, but that is no reason for placing them between the "Titmice" and "Wrens". As the author says they are probably more properly placed amongst the *Timeliidæ* where accordingly one would have expected him to have placed them.

The second portion of "Birds of Burma" consists of a distribution list of birds according to certain areas as defined by the author.

In the introduction to the list he divides Burma into ten areas, but in the distribution list itself, he reduces them to 7, omitting Myithyone, the Northern Chin Hills and Arrakan.

In many ways this is a really valuable piece of work and of a far higher standard than the preceding portion of the volume from which it might well have been separately published. In combining the two parts, one is led to infer that the author has compiled this list in the hopes that the casual observer and budding naturalist, for whom alone the early part of the book is undoubtedly intended, will add to it his own records of observations. Now unscientific observations upon Zoological distribution are valueless, and the record therefore of a bird's occurrence, given on the strength of identification arrived at from a perusal of the descriptions given in "Birds of Burma," would not be worth placing on paper, except for the personal gratification of the writer.

Major Harington's list, as it now stands, compiled from his own observations and from the Ornithologists he quotes, is a valuable addition to the literature on Indian Ornithology, but if improved (?) and added to by his readers (with few exceptions), would steadily become less and less authentic and reliable.

Both parts of "Birds of Burma" will well stand reproduction, but we should like to see the two parts separated. The first part would be more readable, if enlarged and carefully edited ; and whilst rather more minute descriptions of the birds are desirable, we should certainly enjoy reading more of the author's interesting field notes.

The second part is a scientific work, and, though of great use to beginners, would be of even greater utility and interest to the advanced field naturalist, who would make it the basis of his own records.

The column which contains the rough notes (4) is perhaps unnecessary, and might be eliminated in favour of a marginal column to be headed "Notes."

E. C. S. B.

PROCEEDINGS

OF THE MEETING HELD ON THE 31st AUGUST 1909.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on Tuesday evening, 31st August, the Rev. Father Dreckman, S. J., in the chair.

NEW MEMBERS.

The election of the following 70 new members since the last meeting was announced :—Rao Nahar Singh of Bedla ; Mr. Carl Gross (Bombay) ; Mr. William Archibald (Rangoon) ; Mr. Jehangir Fardunji Dastur (Bandra); Mr. W. Harris (Dacca) ; Principal, College of Agriculture (Bengal, Bhagalpur) ; Mr. E. A. Smythies (Naini Tal) ; Mr. Maung Po Bye, K. S. M. and F.R.C.I. (Myaungmya, Burma) ; Mr. Reginald Edward Vere Argyle (Madras) ; Mr. N. V. Parames (Ernakulam, Cochin State) ; Mr. Sydney A. Christopher (Rangoon) ; Mr. A. W. Mercer (Kohat) ; Mr. H. G. FitzGerald (Kohat) ; Mr. R. M. Maxwell, I.C.S. (Karwar); Mr. E. O. Shebbeare (Jalpaiguri) ; Mr. W. H. Barnet (Meiktilla Cantt., Burma) ; Mr. E. Alan Hay (London, W.) ; Mr. P. Eccles (Nagpur) ; Mr. R. D. Hoste (Raipur, C. P.) ; Major H. N. Kelley (Jubbulpore) ; Dr. Scoresby-Jackson (Abu Road) ; Mr. H. A. Shore (Waltair, Vizagapatam Dist.) : Mr. G. Whittall (Mandalay) ; Mr. A. B. Aitken (Punjab) ; Capt. J. H. Murray, I. M. S. (Port Blair) ; Mess President, 109th Infantry (Santa Cruz) ; Mr. D. L. Drake-Brockman, I. C. S. (Naini Tal) ; Mr. H. H. Craw, I.C.S. (Rangoon) : Mr. W. T. White (Mandalay) ; Mr. H. H. Clair Smallwood (Thabeitkyin, U. Burma) ; Mr. Horace E. Candy (Toungoo) ; Mr. G. G. Rorie (Toungoo) ; Mr F. G. Fitzherbert (Toungoo) ; Mr. C. A. Petley (Toungoo) ; Dr. J. H. Sheldon (Toungoo) ; Mr. J. D. Grafton Wignall (Malakand) ; Lt. J. E. B. Scrafton, I.A. (Secunderabad) ; Mr. P. Burd (Sylhet) ; Lt. F. Stevenson, M.B., I. M. S. (Imphal) ; Mr. H. M. Inman, I.M.S. (Somaliland) ; Mr. Ernest Lund (Balur) ; Lt. R. A. C. Murray (Islamabad, Kashmir) ; Capt. W. Blanford, R.A. (Kohat) ; Mr. J. H. McCudden (Poona) ; Mr. F, St. J. Ballantine (Hafflong); Mr. F. St. J. Gebbie (Karachi) ; Mr. W. C. McLeod (Mergui) ; Lt. F. B. Scott (Fort Lockhart) ; Rev. H. J. Buxton (Rangoon) ; Mr. S. Gaddum (Bombay) : Mr. H. B. Saxby (Bombay) ; Mr. F. B. Leach (Rangoon) ; Mr. V. T. Janson (Bombay); Capt., Michael-Lloyd Ferar (Lyallpur); Capt. L. P. Brassey (Burma); Mess Secretary, 91st Punjabis (Meiktilla Cantt.) ; Mr. C. A. White (Dacca) ; Mr. A. Feilman (Dacca) ; Mr. P. L. Faulkner, F.R.G.S. (Dacca) ; Mr. R. Branford (Dacca) ; Lt. G. S. Husband, I. M. S. (Fort Lockhart) . Mr. D. Burns (Jubbulpore) ; Mr. C. R. Barnett (Washington, D.C., U.S.A.); Lt. H.L. Haugton (Rawal Pindi) ; General Mohun Shumshere Jung Bahadur Rana General (Nepal) ; Mr. A. W. Robert (Madras) ; Capt. C. H. Reinhold, I.M.S. (Kohat) ; Mr. H. McComas (Maymyo); the Mess Secretary, 58th Rifles, F. F. (Kohat) ; Capt. H. V. Bagshawe, R.A.M.C. (London).

CONTRIBUTIONS TO THE MUSEUM.

The Joint Honorary Secretaries acknowledged the following contributions to the Museum since the last meeting:—

Contribution.	Locality.	Contributor.
21 Skins of mammals, including a monkey (*Macacus fascicularis*), several squirrels (*Sciurus prevosti condurensis, S. p. carimonensis, Sciurus vittatus nesiotes, S. v. peninsularis, Rhinosciurus leo rhionis*), a tree shrew (*Tupaia ferruginea*), two rats (*Mus firmus* and *M. lingensis*) and a mouse deer (*Tragulus stanleyanus perflavus*).	Malay Archipelago.	Trustees of the British Museum.
3 Rats (*Mus wagneri*), four voles (*Microtus arvalis* and *Ellobius tancrei*)	Tian Shan, C. Asia.	Do.
Great Indian Rhinoceros (*Rhinoceros unicornis*) headskin and skull.	Assam..................	A. Butcher.
Gaur (*Bos gaurus*) skull and horns	....	R. A. Wilson, I.C.S.
Ibex (*Capra* sp.) mask	Chamba State	Major Rodon.
2 single horns of Spotted Deer (*Cervus axis*)	Nimar, C. P..........	Mr Justice Macleod.
Musk deer (*Moschus moschiferus*) skull and headskin.	Chamba State	Major Rodon.
4 Flying Squirrel skins and several small mammal skins.	Do.	Do.
Variety of the Black Rat (*Mus rattus*) ...	Amritsar District...	Capt. Davis.
2 Snakes (*Lycodon aulicus* and *Trop. piscator*).	Jhansi	Lt. C. Thornhill.
1 Green pit viper (*Lachesis gramineus*) (alive).	Karli	P. Gerhardt.
1 Green pit viper (*Lachesis gramineus*) variety (alive).	Darjeeling............	A. Wright.
1 Phoorsa (*Echis carinata*)	Ajmer	J. Stripp.
19 Snakes including *Xenopeltis unicolor, Homalopsis buccata, Tropidonotus subminiatus, Lycodon mackinnoni, Typhlops diardi*, and *Bungarus niger*.	Various	Major F. Wall, I.M.S.
1 Lizard (*Eulbepharis sp ?*)......................	Multan	Major O. A. Smith.
72 Specimens of Coleoptera and Hemiptera.	Garhwal...............	Lt. A. G. Lyell.
A number of Coleoptera..............................	Gauhati, Assam ...	L. G. Middleton.
Do do.	Kashmir	Lt. W. Logan Home.
Several scorpions	Madras	H. N. Dwane.
A number of insects	Bombay	Messrs. J. E. Needham & S. Gaddum.
A number of Hymenoptera, Hemiptera and Coleoptera.	Nepal	Lt.-Col. Manners-Smith, V. C.

Minor contributions from Mrs Drake, Mrs. J. Cunningham, Colonel Mullins, Lts. C. Thornhill and Scott, Messrs. H. Blair, F. Hearson, A. K. Smith, E. C. Reid, P. M. D. Sanderson, H. B. Saxby, D. C. Batten and P. Hearne.

Lecture on "THE ORDERS OF INSECTS AND HOW TO RECOGNISE THEM."

Mr. Maxwell Lefroy, the Imperial Entomologist, by means of diagrams and coloured slides, showed the different orders into which insects are divided. The lecture was a brief survey of the insect world illustrated by nearly one hundred slides of common insects.

At the conclusion of the lecture Mr. John Wallace moved a hearty vote of thanks to the lecturer, which was seconded by Colonel Bannerman, I. M. S., and carried unanimously.

BALUCHISTAN NATURAL HISTORY SOCIETY.

EXTRACTS FROM THE PROCEEDINGS OF A MEETING OF THE MEMBERS HELD IN THE QUETTA MUSEUM AND LIBRARY BUILDING ON THURSDAY, 24TH JUNE 1909.

In the absence of the Hon'ble Sir Henry McMahon on leave, the chair was taken by Colonel D. O'Sullivan.

Read list of the donations received by the Museum since the last Meetings, the exhibits themselves being passed round. Of these the more important were :

A collection of neatly mounted butterflies from Quetta, presented by Lieutenant R. G. Bignell. Numerous specimens of the Cicada (*Sena quærula*) presented by the Hon'ble Colonel C. Archer and other members, with numerous pupæ and cast-off skins of the same presented by Mr. J. W. N. Cumming.

Read letter, dated 7th June 1909, from Doctor Annandale, stating that the Reverend T. R. Stebbing had identified the Quetta Isopod as *Hemilepistus crenulatus* (Pallas), having *Porcellis klugii* (Brandt) for a synonym.

The Honorary Secretary also passed round for the information of members:—

Six bound volumes and some unbound parts of Dr. Moore's valuable work entitled " Lepidoptera Indica " presented to the Museum by the Government of India in the Home Department.

In conclusion Colonel O'Sullivan expressed regret at the absence of the Hon'ble President, thanked Messrs. Bignell and McDonough for their valuable donations to the Museum, and expressed the hope that some of the Members would take up the study of the Cicada (*Sena quærula*) now swarming all over Quetta. He pointed out that the present afforded an excellent opportunity of watching the development of the insect from its earliest stage as the cycle of its life history had evidently now begun. He suggested that the study be undertaken by some of the permanent residents in the station as, owing to the life history of the insect covering a period of some 5 or 6 years, it was obviously impossible for a temporary resident to observe all the developments. He added that this was an excellent opportunity for some one to make a name for himself.

Colonel O'Sullivan further stated that Captain Smallman was busy trying to solve the housefly problem and expressed the hope that he would be able to place before the next meeting the result of his labours.

In conclusion he suggested that greater attention be paid by members to the study of the Moths of Baluchistan.

Sena quærula (Pallas).

The flying insect, which at present swarms all over Quetta making such a continuous grating noise, belongs to the Order Rhynchota or Bugs, Suborder Homoptera or equal winged Insects, Family Cicadidæ, Sub-family Gæaninæ, Division Cicadatraria, Genus Sena (Distant) and belongs to the Species named *Sena quærulla* (Pallas).

An interesting description of both the Family and Species will be found given at pages 55 to 57 and 135 to 136 respectively of the Fauna of British India, Rhynchota, Vol. III. I have had my home in Quetta for the past 19 years but this is the first time I have seen the Cicada in such swarms. It appears, however, from Major Anscomb and other older residents who have been more continuously in the station than I have been that similar swarms have been known to visit the place at intervals of about 6 years, the last occasion being in 1903 when I was out of the station.

The first specimen seen by me this year was brought by my son on the 11th inst. The same day the Hon'ble Colonel Archer captured some and sent them over to the Museum. A few days later I secured a number but of a smaller size near Baleli. On the 18th I went down to the Lora and found the willow trees there covered with them, while under the trees it looked as if it were raining. I at first thought this was due to these insects bleeding the trees, but on approaching nearer I found that the insects themselves were giving out a fluid discharge.

The same evening I noticed numerous empty pupæ skins slit open down the back hanging from the low shrubs which there covered the ground, and which is called locally Busandak (Brahui), Ghurezha (Pastu) and botanically *Sophora alopecuroides* (Linn), while the ground itself was perforated with numerous small holes, each about half an inch in diameter. Seeing these empty pupæ skins in such numbers, I concluded that they had been cast off by the flying insect under consideration. Not having time that evening to dig up any of the holes, I was going away when I noticed a young *Echis carinata* in one of them. This I soon got out with the help of a little water.

This morning I again visited the place and selecting a spot where the holes were very numerous,—20 in a space 18 inches square—I set a man to dig up the ground, carefully examining each hole separately.

The holes, I would add, were open to the sky and went down more or less vertically to a depth varying from 11 inches to 2 feet, widening slightly at the bottom for about 1½ or 2 inches to a diameter of ¾ inch.

Each hole was separate, none meeting anywhere, even though some of them were less than an inch apart.

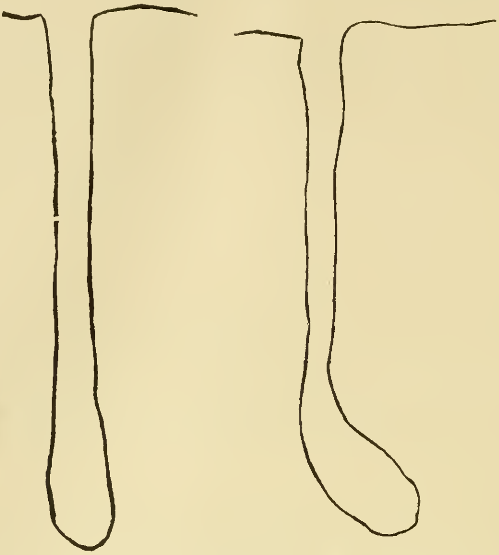
At the bottom of about some 6 or 7 holes, I found some beetle-shaped pupæ which I now place before the meeting.

Of these, an injured specimen appears to have been on the eve of splitting open when dug up.

These pupæ, it will be observed, are just able to crawl, each limb being enclosed in a separate sheet.

Though the holes had been bored in ground covered with the Busandak shrub, very few of them came into contact with any roots and seemed intended merely to hold the insect in its pupæ stage.

The following two rough sketches indicate how the holes were bored.



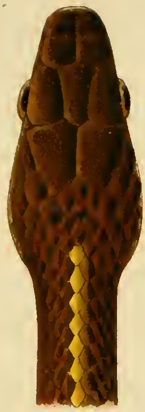
There was only one pupæ in each hole, and, as already stated, the mouth of every hole was quite open.

It will be interesting and useful if others will also take the trouble to study the life history of this insect in all its stages.

J. W. N. CUMMING,
Honorary Secretary.

QUETTA, 24*th June* 1909.

735



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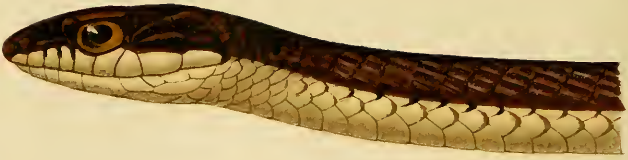

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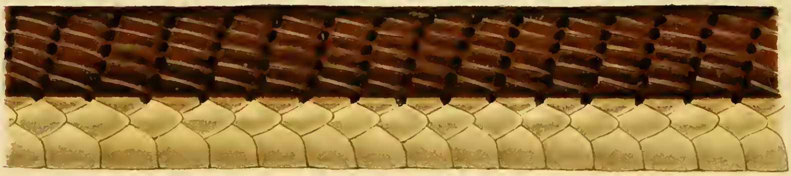

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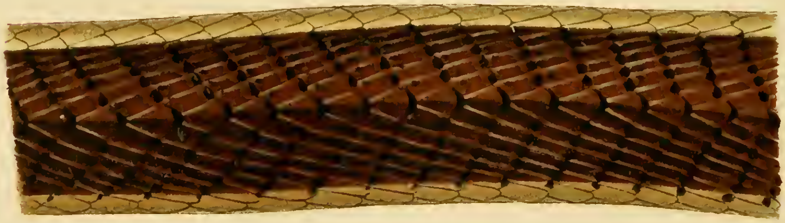

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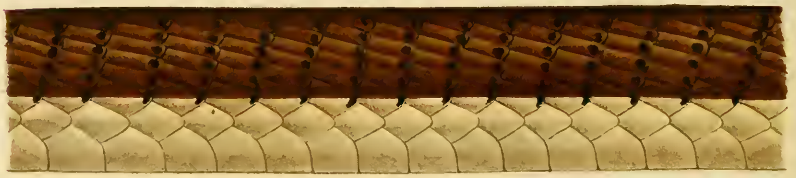

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J G del.

J.Green, Chromo

THE COMMON INDIAN SNAKES, (Wall).

Dendrophis pictus, *harmless, nat.size*

MARINE BIOLOGICAL LABORATORY
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JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XIX. BOMBAY. No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I. M. S., C. M. Z. S.

Part XII with Plate XII and Diagram and Map.

(Continued from page 563 of this Volume.)

The genus *Dendrophis* as now understood comprises at least 11 species, distributed in Southern Asia between India and Indo-China, through the Malayan Archipelago to Eastern Australia. Of these species 6 occur within our Indian limits, *viz.* (1) *pictus* (Eastern Bengal, Eastern Himalayas, Irrawaddy-Salween basin, and Tenasserim and further East to Indo-China), (2) *grandoculis* (Hills of Southern India), (3) *bifrenalis* (Ceylon and Travancore Hills, Ferguson), (4) *caudolineatus* (Ceylon), (5) and (6) *gorei*,[*] and *proarchos*[†] (Brahmaputra basin).

Until 1890 several other species were included which have now been grouped together on characters affecting dentition under a separate genus called *Dendrelaphis* by Mr. Boulenger. This genus includes 3 species found in Indian Territory, *viz.* (1) *tristis* (Peninsular India, Eastern Himalayas, Brahmaputra Valley and Ceylon): (2) *subocularis* (Hills of Upper Burma); and (3) *biloreatus*[‡] (Brahmaputra Basin).

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[*] Described by me in this Journal, Vol. XIX., p. 829. [†] Described by me in this Journal, Vol. XIX., p. 827.

[‡] Described by me in this Journal, Vol. XVIII., p. 273.

The species of both genera are very much alike, so much so indeed that some have been much confused. For instance every author who wrote before Mr. Boulenger's present classification was inaugurated, alluded to *Dendrelaphis tristis*, and *Dendrophis pictus* as one and the same snake under the latter title, and the confusion did not end here, for every writer since has committed the same mistake.

I have heard doubts expressed in some quarters as to the justification for the recognition of the two genera just referred to, but as I have a series of skulls of the types of both, I am in a position to be able not only to affirm that the differences claimed exist, but to add others in support. Mr. Boulenger divided the species on characters affecting the maxillary teeth, grouping together those in which the teeth enlarged posteriorly under the heading *Dendrophis*, and those in which they reduced posteriorly under the title *Dendrelaphis*. Figures A. and B. taken from the skulls of specimens of both obtained at Pashok in the Eastern Himalayas illustrate the differences in dentition, but I find in addition that there are decided differences in the shape of the nasal bones, and also in the ridges for muscular attachment on the parietal bones of each (*see* Diagram and figs. A. and B.). The confusion in literature between *D. tristis* and *D. pictus* just referred to makes it difficult for me to speak very positively on the distribution of these species, but I present the facts as they appear to me, with the hope that our readers who are in a position to do so will send me specimens that will enable me to confirm or refute them.

DENDRELAPHIS TRISTIS (Daudin.)

The Indian Bronze-Backed Tree Snake.

History.—The first reference to this snake was made by Russell over a century ago. In 1796[*] he figured and remarked upon a specimen from Hyderabad (Deccan). In 1801 [†] he figured and referred to two others from Bombay and Tranquebar.

Nomenclature.—(*a*) *Scientific.*—The generic name from the Greek δεγδρον a tree, and ελαφις snake, was introduced by Mr. Boulenger in 1890. *Tristis*, the specific title from the Latin "sad" was conferred by Daudin in 1803 in allusion to its sombre colouration.

(*b*) *English.*—The Common Indian Bronze-Backed Tree Snake or

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[*] Ind. Serp. Vol. I, p. 36 and Plate XXXI. [†] Vol. II, pp. 29 and 30 and Plates XXV and XXVI.

Bronze Back. I have heard it alluded to as the painted tree snake, but since all the species are alike in the cærulean adornment which suggested the term painted, this adjective is equally applicable to all.

(*c*) *Vernacular* —In Ceylon Ferguson* says it is called "haldanda." Mr. E. E. Green interrogated two intelligent Singhalese with respect to this term, and they said they knew a snake of this name which they described as "a very swiftly moving snake of a dark-brown colour," and said it had a yellow belly. The word is from "hal" rice and "danda" a stick or whip. The connection is not very obvious but an observation of Annandale and Robinson's with regard to the snake *D. pictus* suggests itself. They remark that it is often found among bushes at the edge of rice fields. One of the two men above referred to told Mr. Green it is also called "katta-kaluwa," meaning black mouthed, but whether this name is rightly applied to this species seems dubious, as it does not appear appropriate. Ferguson † mentions this term in his list of Singhalese names for snakes, but without specifying the species.

Confusion in vernacular nomenclature with regard to snakes is great, thus we find another Singhalese name, *viz*, "ahaetulla" wrongly applied to this species. Linné‡ in 1754, Laurenti § in 1768 and others since have made use of the term in reference to the snake now identified by Boulenger as *D. pictus*, but it is clear that the word emanating from Ceylon refers rather to the Ceylon snake *tristis*. There is however, now, I think no doubt that "ahaetulla" is the correct Singhalese name for the green whip-snake (*Dryophis mycterizans*), the word implying eyeplucker being synonymous with the "kan-kotti-pambu" of the Tamils in Southern India. Further confusion has arisen with regard to the name "kumberi-muken." Russell¶ connects this name with the snake *D. tristis*, and many others subsequently have followed him, but I think there can be no doubt that it is correctly applied to the green whip-snake (*D. mycterizans*). The name meaning "snouted tree snake" obviously suggests the green whip-snake, and is quite inappropriate to the common bronze-back. Moreover, in a printed copy of a lecture on snakes delivered some years ago by the Rev. Fr. Bertram, S. J., of which I have a copy, this authority says "I believe these two different names (kan-kotti-pambu and kamberi-mukken) denote the same snake; for, while the kan-kotti-pambu is acknowledged by all to be the green tree-snake, there is no other tree-snake with an elongated snout which would justify the name kamberi-mukken." Further, the Revd. C. Leigh, S. J., who has 13 years' experience of Trichinopoly, recently wrote to me in response to my enquiries that green whip-snakes were frequently kept in captivity at St. Joseph's College, and the students and visitors repeatedly applied the name kamberi-mukken," "patchai-pambu" and "kan-kotti-pambu" to this species.*

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* Rept. fauna of Ceylon, 1877, p. 20. † loc. cit. p. 40. ‡ Mus. Ad. Frid p. 35, Plate XXII., fig. 3. § Syn. Rept. p. 79. ¶ Ind. Serp. Vol. I, p. 36 and Plate XXXI.

Jerdon† mentions "chitooriki-pambu" as one of the names in use in Southern India, and Dr. J. R. Henderson tells me he has known it called "panaiyeri-pambu" meaning palmyra snake in the same part of India. According to Russell† it is called "rooka" in Mahratti, "goobra" about Hyderabad (Deccan), "maniar" about Bombay, and "mancas" in Guzerat. Mr. E. Muir tells me that at Kalna, Bengal, it is called "bet anchora" which means "lacerated with a cane." In Cannanore I heard it called "villooni" from the Malayalam villoo a bow (see legends hereafter).

Colour and markings.—Dorsally the body is uniformly purple brown, bronze-brown or rarely ruddy-brown, except for the vertebral region which is usually more or less distinctly lighter, and the last row and a half of scales in the flanks, which are yellowish. The vertebral stripe involves the vertebral and half the next row. It may be conspicuous in the whole body length, or only anteriorly. In the neck and fore body a series of oblique, black streaks, often paired, and usually more or less broken up are always more or less evident. A yellow flank stripe passes from the neck to the vent. It is bordered above by a blackish, somewhat indistinct line, but unlike *pictus* is not bordered below by a black line running along the edge of the ventrals.

When the snake under excitement dilates itself, small oblique patches of light sky blue on each scale on the back are brought into view, especially noticeable and brilliant in the forebody. Each patch of blue is broadly edged with black anteriorly, and posteriorly and placed on the lower half of each scale so that it is usually com-

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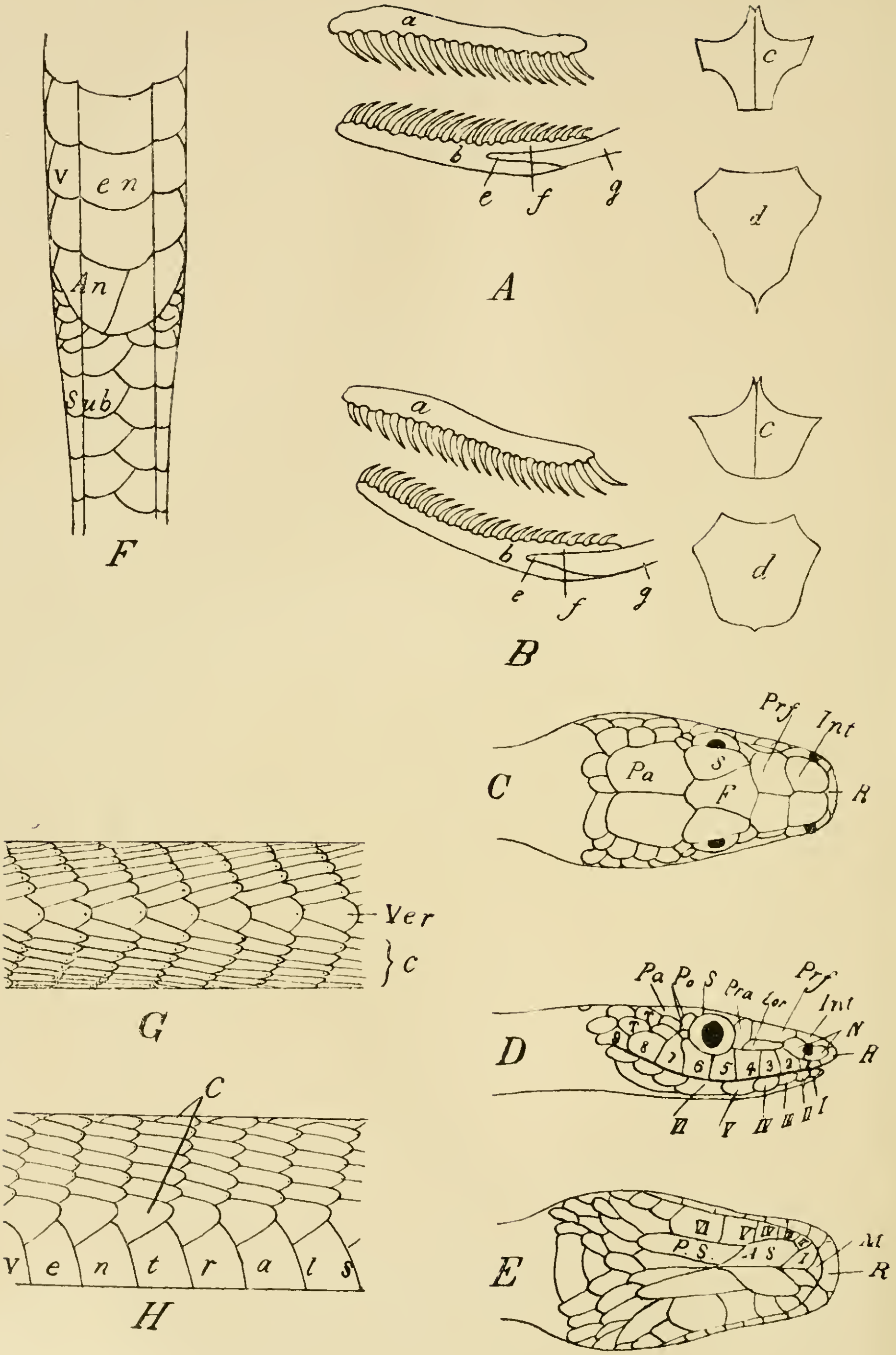
* The confusion is on a par with the Singhalese "karawella," wrongly ascribed by Günther to the Ceylon pit viper (*Ancistrodon hypnale*). Subsequent authors repeated the mistake on his authority, but there is now no doubt, I believe, that it is properly applied to the Ceylon krait (*Bungarus ceylonicus*).

† J. A. S. Bengal XXII, p. 529. loc. cit.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COMMON INDIAN SNAKES (WALL).
(*Dendrelaphis tristis*).

THE COMMON INDIAN SNAKES.

EXPLANATION OF DIAGRAM I.

A.—*DENDRELAPHIS TRISTIS*, jaws.
B.—*DENDROPHIS PICTUS*, jaws.

- (*a*) maxilla.
- (*b*) dentary part of mandible.
- (*c*) nasal bones.
- (*d*) ridges on parietal for muscular attachments.
- (*e*) articular notch.
- (*f*) articular process of dentary.
- (*g*) articular part of mandible.

C. D. E.—HEAD SHIELDS.

A. S.	Anterior sublinguals.
F.	Frontal.
In.	Internasals.
Lor.	Loreal.
M.	Mental.
Na.	Nasals.
Pa.	Parietals.
Po.	Postoculars.
Pra.	Præoculars.
Prf.	Præfrontals.
P. S.	Posterior Sublinguals.
R.	Rostral.
S.	Supraoculars.
T.	Temporals.
1, 2, 3, etc.	Supralabials.
I, II, III, etc.	Infralabials

F.—BELLY SHIELDS.

Ven.	Ventrals with ridges.
An.	Anal.
Sub.	Subcaudals with ridges.

G. H.—BODY SCALES.

C.	Costals.
Ver.	Vertebrals.

pletely concealed by the overlapping of the scale below it. In our Plate (figures 3 and 4) this ornamentation is not done justice to, the blue being neither bright enough nor broad enough. The head is coloured above like the back, but the upper lip is yellow, creamy-buff, or opalescent abruptly demarcated above. There is a roundish yellow spot in the suture between the parietal shields (not shown by our artist), thin black edges to the 2nd, 3rd and 4th supralabials (sometimes the 1st also), and a somewhat obscure, narrow, black postocular streak not or hardly extending to the neck. The belly is uniform creamy-yellow, pale-greyish, greenish, or bluish green.

The markings to which special attention is to be paid are (1) The interparietal spot; (2) The light vertebral stripe; (3) The black posterior margins to the anterior supralabials; (4) The narrow, short, and often obscure black postocular streak and (5) a more or less obvious black line separating the dorsal brown from the yellow flank stripe. I find these present (except (1) and (2) in a single example from Marmagoa) in all the specimens I have examined from the localities mentioned hereafter under distribution, and none of these are present in specimens of *Dendrophis pictus.* In the Eastern Himalayas where these two species are associated (on slopes below Darjeeling) I saw many specimens last year, and learnt to discriminate between them at a glance, by the marks above referred to.

Dimensions.—The longest measurement I know is 3 feet 9 inches. I obtained a specimen of this length in Trichinopoly.

General characters.—The Indian bronze-back is remarkably elegant in colouration, and form. Its head is rather elongate, snout bluntly rounded, nostril small, and the eye large and lustrous with a golden iris and round pupil. The neck is very distinctly constricted, the body long, slender, smooth, and rather depressed (*i.e.*, flattened from above downwards). The belly is conspicuously ridged on either side as in *Chrysopelea ornata.* An unusually long tapering tail accounts for nearly one-third the total length of the snake. This appendage is ridged beneath in the same manner as the belly.

Identification.—The dual combination of enlarged vertebrals, and ridged ventrals (*see* Diagram I, figs. F and G) proclaims any snake either a *Dendrophis* or *Dendrelaphis*, so that it remains to distinguish this species from others in these two genera. Only 6 of these have 15 rows of scales in midbody, and the differences between them will be seen at a glance at the following table.

Number of scale rows in midbody.	Vertebrals as broad or broader than long.	Ventrals.	Anal.	Subcaudals.	Loreals.	Labials touching the eye.	Name of species.
15	Yes	177 to 211	2	131 to 153	1	normally 4th 5th & 6th.	*Dendrophis pictus.*
15	Yes	154 to 171	2	144 to 155	2	5th & 6th	,, *bifrenalis.*
15	No	168 to 197	2	115 to 134	1	5th & 6th	*Dendrelaphis tristis.*
15	?	167 to 172	2	74 to 105	1	5th	,, *subocularis.*
15	?	174 to 188	2	117 to 124	1	4th, 5th & 6th	,, *grandoculis.*
15	Yes	184 to 195	1	141 to 153	1	4th, 5th & 6th	,, *proarchos.*

The most important characters to distinguish *tristis* from its allies are the narrow vertebrals in which the length very distinctly exceeds the breadth, and only two labials touching the eye. To sum up then any snake in which the vertebrals are enlarged, but obviously longer than broad, with ridged ventrals, 15 scale rows in midbody, (*i.e.*, between snout and vent) and two labials touching the eye is *Dendrelaphis tristis.*

Haunts.—The common Indian bronze-back like all its allies lives almost entirely in bushes and trees, I became most familiar with it in Trichinopoly in my early Indian days, when I spent a good deal of my leisure time birdsnesting. During my daily excursions I frequently came across it, and have indeed met as many as three or four in a single outing. I frequently discovered it lying on a branch, when peering through low scrub, and if the snake lay still the chances were it would escape detection, looking extremely like a small branch itself. There is no doubt that its colouration is decidedly protective.

An observation of Mr. E. E. Green's in a recent letter exemplifies this. He says—on the 8th of September 1903, he "placed a branch with green foliage in the snake's cage. Formerly all the different snakes coiled up together amongst the dry foliage of a dead branch, but now they have sorted themselves, the green whip snakes (*Dryophis mycterizans*) have moved on to the green branch while the *Tro-*

pidonotus and *Dendrophis* (*Dendrelaphis*, F. W.)—both brown snakes —have remained on the dead branch."

Often gazing up into trees a movement in the foliage twenty or more feet above drew my attention to a snake which when shot proved to be this species. I encountered it more than once in holes in trees, sometimes detecting the snake from the ground level with its head peering forth, or when aloft investigating a likely hole for a bird's nest. Under the latter circumstances a cane thrust into the hole and briskly stirred about effected its exit. Once the snake vacated its quarters so hastily that it fell to the ground. On one occasion in Colombo, I discovered one in the open, and pursued it but it got into grass, and disappeared beneath a log. With some difficulty the log was overturned, but the snake could not be seen, and yet the ground was such that it was impossible for it to have escaped in any direction unseen. After a considerable search a narrow hole was discovered in the log in which the snake proved to have taken refuge. On more than one occasion I have found its slough entwined among the twigs of a crow's nest, which it had evidently visited with the intention of disencumbering itself of a worn-out vestment, as the slough was perfect or nearly so. On one of these occasions I found the snake in a hole in the same tree, and matched it with the slough.

It not infrequently comes to the ground, and I have often flushed one near the base of a tree, and seen it disappear up the trunk like a flash before I had time to recover the start that such an encounter always gives me. Dr. Henderson, too, remarks in a letter to me that he thinks it visits the ground more often than the whip-snake (*D. mycterizans*). It frequently clambers into the creepers about bungalows, and from here creeps on to the tiles.

Disposition.—Though Günther* says of it " When old it is rather ferocious and bites readily " my experience goes to show that it is a timid snake, usually making off with great despatch when alarmed. I have never been struck at by the specimens I have met face to face, or rudely evicted from holes in trees. The specimens I have handled, too, have never attempted to bite me, but it gives me little chance of ascertaining its temper, for if liberated with the object of being played with, it takes advantage of its release so precipitately, and moves with such speed, that the captive of one minute has regained its liberty the next, and is lost among the branches of the nearest tree. Mr. E. E. Green says that specimens he has kept have always been quite gentle and never attempted to bite when handled. Dr. J. R. Henderson, in a recent letter to me, remarks that in captivity it becomes very tame and inoffensive. Mr. Ingleby quoted by Ferguson says that it is a very lively, and plucky snake, and the fact that Mr. E. E. Green found one devouring a large blood-sucker lizard (*Calotes versicolor*), a most truculent creature when brought to bay sufficiently establishes its reputation for courage, when hunger presses.

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* Rept. Brit. India, p. 297.

Habits.—In a former paper of this series I made some remarks upon "flying" snakes (Under *Chrysopelea ornata* in Vol. XIII). It is probable that the common Indian bronze-back can undertake feats of the same nature, for it is endowed with the same peculiar ridges on the belly, that are seen in *Chrysopelea*; further, its close ally *Dendrophis pictus* is one of those snakes that has been reported to spring (fly) from heights. So far as *tristis* is concerned, however, the evidence, though suggestive is not so well authenticated. Though neither Dr. Willey nor Mr. E. E. Green are aware of any native stories of springing or "flying" snakes in Ceylon, Pridham* speaks of a snake called by the natives "ahedoella," and says: "The movements of this snake are rapid, and from its power of springing it is called a flying snake." The evidence seems pretty clear therefore that a "flying" snake exists in Ceylon, but there would appear to be a mistake in the diagnosis of the species for "ahedoella" is the Singalese name for the green whip-snake. (*Dryophus mycterizans*) a far commoner snake which has no reputation for springing as far as I am aware in any of the Provinces included within its wide distribution, and has an entirely different conformation of belly shields. So far as Southern India is concerned Dr. J. R. Henderson tells me that "There is a common belief that *D. pictus* (by which he means *D. tristis*) can jump, but I have never seen it do so."

Its movements are surprisingly rapid as already remarked. It is truly astonishing with what speed it can ascend an almost bare tree trunk from the ground, and disappear in the branches above. I have seen this several times, and it has always struck me that its speed in ascent is as rapid as its movements along the flat. Mr. E. E. Green has been struck by its restless habit and the quickness of its movements.

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* Ceylon and its Dependencies, p. 750.

The tenacity with which it can maintain its hold in foliage under most disadvantageous circumstances I have more than once been witness to. I managed to hustle one on one occasion to the extreme tips of the branches of a small neem tree, but though the slender twigs swayed boisterously under its weight and movements, it remained firmly suspended until I dislodged it with a stick.

Any opportunities of exhibiting its natatory powers are probably rare, but that these are creditable seems certain, for I once encountered one (unless it was *D. pictus*) on a small island in Chilka Lake fully 2 miles from the main land.

Food.—This tree-snake appears to me to subsist under natural conditions chiefly on lizards, but does not disdain other reptilian fare. Mr. E. E. Green tells me that in captivity "it feeds readily upon small lizards *(Agamidæ, Geckonidæ, and Scincidæ)*". He saw one once take and eat a gecko which it swallowed immediately alive. He also once encountered one eating a full-grown "blood-sucker" lizard* *(Calotes versicolor)* and tells me further that young examples are said to feed on grasshoppers. Ferguson quotes Mr. Ingleby as saying that it is very keen after frogs, and particularly tree frogs. Mr. C. Beadon tells me that he once found one eating a blind snake *(Typhlops* sp.) which returned to its kill after having been once disturbed. On occasion it will attack and plunder birds' nests. I once witnessed an encounter between this snake and a pair of black-backed robins (*Thamnobia fulicata)* in the Borella Cemetery in Colombo. My attention was attracted by the distressed behaviour of the birds, which I approached cautiously, and saw on the ground-between a group of gravestones a *tristis* with its head well erected. I was so near that I both saw and heard more than one peck delivered (it appeared to me on the head) by the birds in their agitated flights to and fro. An incautious movement on my part, and the snake had slipped away, and no amount of search could reveal its whereabouts. In a croton bush within a yard or two of the encounter I found the robin's nest with eggs. Specimens in the Madras Museum† have fed freely. One ate 79 toads and 1 lizard between the 12th August and 31st March; another 94 frogs from the 1st April to the 21st January following: a third 18 frogs between the 13th February and 31st of March; and a fourth 104 frogs, presumably during the year.

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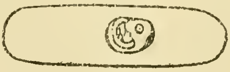
* Spol Zeylanica. April 1906, p. 220. † Administration Report, Madras Govt. Mus., 1896-97.

Sloughing.—Some excellent notes on this little studied function were made in the Madras Museum some years ago.* During the official year 1896 one shed its skin on the 2nd April, 6th May, 28th June, 27th July and 29th October. Another on the 13th May, 16th June, 21st July and 17th October. In a third instance a specimen which was acquired on the 12th August sloughed on the 24th October. Now, it is very curious, and apparently something beyond coincidence, that in all three cases there was no desquamation in the months of August and September, though in the first two cases there had been a regular ecdysis in several preceding months.

Breeding.—My notes are very meagre in this direction, but sufficient to show that the species is ovoviviparous. I received a gravid ♀ on the 29th February 1904 from Mr. Angus Kinloch (Kil Kotagiri, Nilgiris). It measured 3 feet $4\frac{1}{2}$ inches, and contained 7 nearly mature eggs, from $1\frac{1}{8}$ to $1\frac{1}{4}$ inches long, and about $\frac{7}{16}$ inch broad. Mr. E. E. Green had a specimen which laid 4 eggs in its cage on the 11th January 1908, and died next day when 2 more eggs were found in the oviduct. These were all sent to me. The smallest measured $1\frac{1}{8} \times \frac{3}{8}$ inches, and the largest $1\frac{3}{8} \times \frac{13}{22}$ inches. In cutting open egg I found an embryo coiled up in a spiral fashion, lying in an elliptical chamber situated in the upper part of the yolk substance, and midway between the two poles. The embryo I judged might be an inch and a half long when unravelled. Its head with the primary cerebral vesicle, eye and lower jaw were well developed, as was also the heart, so that it was in just about the same stage of development, that I noted in the case of the Assam species *Dendrophis proarchos*, at exovation. †



Egg showing embryo of *Dendrelaphis tristis* from a specimen from Ceylon. (Natural Size.)

Though the species is obviously oviparous it is probable that minute embryo are already in process of formation at the time that the eggs are extruded, for in an allied species in Assam (*proarchos*, Wall) I found embryos in the eggs when laid, and noted that I could see the head and eye and rudiment of lower jaw, and could observe the heart beating. Further observations are required to ascertain if *tristis* lays eggs in which the embryos are equally well developed.

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* Administration Report, 1896-97.

† Since writing this I have received another gravid ♀ from Mr. Green from Peradeniya (Ceylon) killed at the end of January and containing 7 nearly mature eggs.

Legends.—There is a general belief among the natives of Southern India that the Common Indian bronze-back is fatally poisonous. Russell* records the belief as prevalent in his time, and says that his snake-catcher professed to have known two men killed by it, the bite producing immediate giddiness and death in two days. There is no reason to reject this snake-man's story, for as I have more than once remarked in these papers deaths do occur from the bites of perfectly harmless snakes. Such fatalities are due to cardiac syncope due to fright. In Bengal too as I am informed by Mr. E. Muir (Kalna) the natives say it is very poisonous and attacks without provocation. Russell† also mentions the belief among natives that this snake having bitten a person ascends a tree near the pyre to watch with vindictive satisfaction the smoke rising from the corpse of its victim, after which it descends. I heard this same story in Ceylon, but was never able to discover exactly which snake it was that was credited with this malignant spirit. Dr. J. R. Henderson tells me the belief is still prevalent in Southern India, and he has known a mock funeral with an effigy organised to save the bitten subject, for when the snake descends from the tree the poison it is supposed to have injected leaves the body, and the otherwise doomed person recovers.

In Cannanore there was another strange belief among the natives who said that this snake could thrust its tail into the ground, balance thereon, and assume the form of a bow, hence their name for it "villoonie" from "villoo" a bow. I was never able to understand with what object it is supposed to evince this strange behaviour.

Distribution. (A) *Geographical.*—The evidence at my command points to this being undoubtedly the common species to be found in the Indian Peninsular and I believe it exists here to the exclusion of *Dendrophis pictus* as far East as Bengal. My earlier notes on the species are unfortunately deficient in the matter of precise colour, and markings, but I can say with certainty that this is the snake I was familiar with in Trichinopoly, and I have taken it in Cannanore. It is certain, however, that the specimens taken in the localities mentioned in the attached map are *tristis*, and not *pictus*.

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* Loc. cit., Vol. II, p. 30.

† Loc. cit., Vol. II, p. 31.

(*b*) *Local.*—It is a common snake in Ceylon (Ferguson, Haly). It is very common about Trichinopoly and Cannanore. Ferguson says it is common in the Plains and Hills about Travancore * and Mr. Millard tells me also about Matheran. Mr. E. Muir reports it as one of the common snakes about Kalna in Bengal, and has sent me specimens. Jerdon says it is abundant in all parts of the country, but with this I cannot agree. It appears to me to be uncommon in the plains to the north of the Tapti Rivers. I do not think it occurs in the Indus Basin at all, except near the mouth of that river. Blanford, collecting for 3 years at Ajmer, failed to obtain a specimen. The Ganges Valley is too, I believe, outside its limits, except at the Eastern part near the Delta. It has not been recorded from Central India, nor seemingly from the Central Provinces. It is quite common in the Eastern Himalayas (circa 2,500 to 5,000 feet) in the vicinity of Darjeeling.

Lepidosis. Rostral.—Touches 6 shields; the rostro-nasal, and rostro-internasal sutures subequal. *Internasals*—Two; the suture between them equal to, or nearly equal to that between the præfrontal fellows, and rather shorter than the internaso-præfrontal sutures. *Præfrontals.*—Two; the sutures between them equal to, or rather greater than, the præfronto frontal sutures; in contact with internasal, postnasal, loreal, præocular, supraocular and frontal. *Frontal.*—Touches 6 shields; the fronto-supraocular sutures three to four times the fronto-parietal sutures. *Supraoculars.*—As long as the frontal, and about as broad along a line connecting the centres of the eyes. *Nasals.*—Two, completely divided; the nostril placed almost entirely in the anterior shield; in contact with the 1st and 2nd supralabials. *Loreal.*—One elongate, twice or more than twice as long as high, about as long as the two nasals taken together. *Præocular*—One, barely reaching the top of the head. *Postoculars*—Two. *Temporals*—Two, elongate. *Supralabials.*—Normally 9 with the 5th and 6th touching the eye†. *Infralabials.*—6, the 6th much the largest, as

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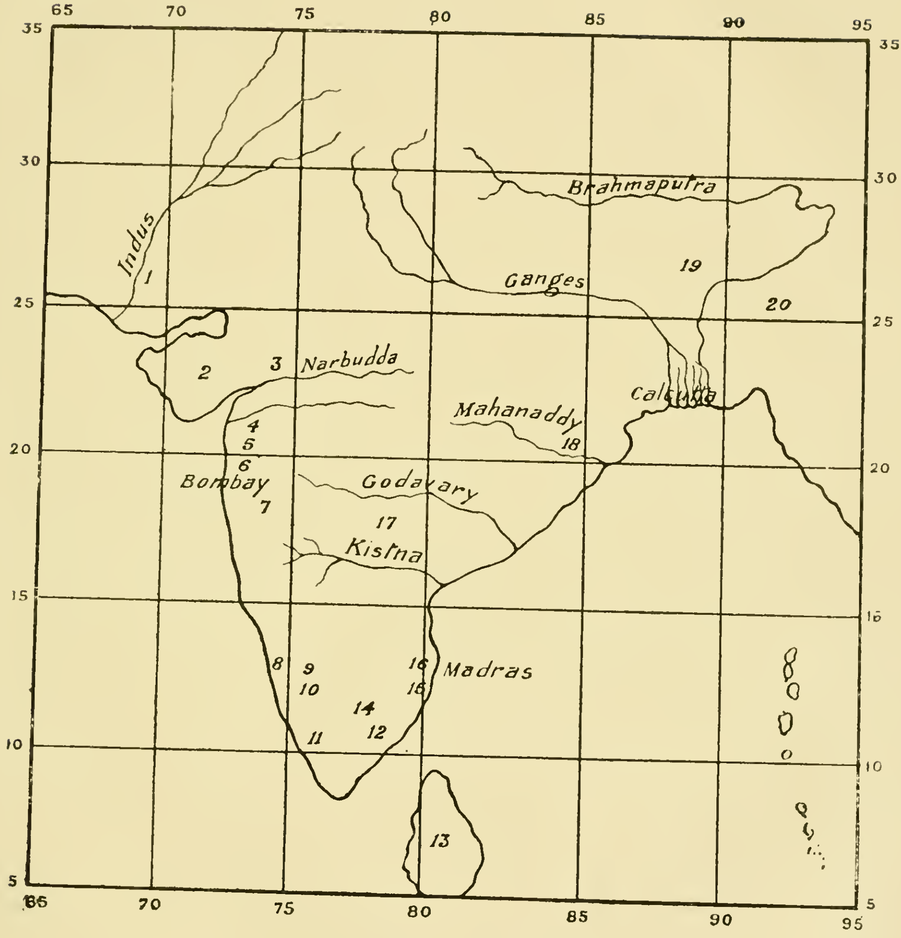
* Bombay N. H. Journ., Vol. X, p. 5.

† This is so in 26 out of 29 specimens I have noted upon. In 2 instances these shields are not recorded, and in a single example the 4th just touches the eye on both sides. In one of the 26, there are 8 shields on one side only, the 4th and 5th touching the eye.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MAP SHOWING DISTRIBUTION OF *DENDRELAPHIS TRISTIS*.

(1) Sind (B.M.). (2) Guzerat (Russell). (3) Baroda (Bo. M.). (4) Surat (Bo. M.). (5) Thana (Bo. M.). (6) Bombay (Russell). (7) Matheran (Bo. M.). (8) Cannanore (F.W.). (9) Kil Kotagiri, Nilgiris (F.W.). (10) Coimbatore (F.W.). (11) Travancore (Bo. M.). (12) Ramnad (I.M.). (13) Ceylon (B.M.). (14) Trichinopoly (F.W.). (15) Tranquebar (Russell). (16) Madras (F.W.). (17) Hyderabad (Russell). (18) Jashpur, Chota Nagpur (Blanford, J. A. S. Bengal, Vol. XL., p. 431). (19) Himalayas below Darjeeling (B.M. & F.W.). (20) Khasi Hills (B.M.).

long on the 3 preceding shields, in contact with two scales behind; the 5th and 6th touching the posterior sublinguals. *Sublinguals.*—Two pairs; the posterior decidedly longer. *Costals.*—15 at a point two head-lengths behind the head, and to well beyond midbody, when they reduce to 13, and then to 11 or even 9, before the vent. The reduction from 15 to 13 is due to the absorption of the 4th scale above the ventrals into the row above or below; that from 13 to 11 results from a fusion of the 5th and 6th rows above the ventrals; and when the number further reduces to 9, the 5th row is absorbed into one of the adjacent rows. The vertebrals are enlarged, but they are very distinctly longer than broad in midbody, they arise in the neck by a fusion of 3 rows, thus differing from the genus *Bungarus*, where they gradually develop from a single row progressively enlarging, and unlike the genus *Bungarus* they cease above the anus. The ultimate row is much enlarged considerably exceeding the vertebral in breadth. Keels are absent everywhere. Apical pits are present, and single. *Ventrals.*—168 to 197, varying in number with locality *; sharply ridged (keeled) on each side. *Anal* divided. *Subcaudals* divided, 115 to 146; keeled like the ventrals. *Dentition.*† *Maxillary.*—17 to 22: the first 3 or 4 progressively increasing, the posterior, 3 or 4 compressed and progressively decreasing, so that the last is about two-thirds the length of the longest in the series. *Palatine.*—11 to 14, subequal, and as long as the longest maxillary. *Pterygoid.* 19 to 24 (except the Kil Kotagiri specimen which has 28 and 29); smaller than the palatine. *Mandibular.*—20 to 26 (usually 20 to 22); the first 3 or 4 progressively increasing, the posterior gradually decreasing. The length of the articular process equals the length from the articular notch (see fig. A. 6) to about the 4th tooth.

DENDROPHIS PICTUS (Gmelin).

The Himalo-Malayan Bronzeback.

Nomenclature. (*a*) *Scientific.*—The generic name from the *δενδροτ* a tree and *οφις* a snake, was applied by Boie in 1827; the specific from the Latin meaning "painted" was given by Gmelin in 1788 in allusion to the sky blue patches on the scales seen in this, and other species of the genera *Dendrophis*, and *Dendrelaphis.*

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* In 19 specimens from various parts of India other than the Eastern Himalayas, they are 168 to 192. In 9 Eastern Himalayan examples they are 190 to 197.

† This is based on 10 skulls in my collection from Pashok (Eastern Himalayas), Madras, Matheran, and Kil Kotagiri (Nilgiri Hills).

(*b*) *English*.—In contradistinction to the last I think it should be called the Himalo-Malayan bronze-back.

(*c*) *Vernacular.*—In the Patani-Malay States Annandale and Robinson* say it is called "ular lidi", "ular"-snake, and "lidi" the midrib of the cocoanut palm. They remark that the appropriateness of the name is realized when one sees a leaf of this palm from below, with the midrib black against the sky, and an apparent light space on either side of it, due to the comparative narrowness of the leaflets where they leave it.

Colour and markings.—Dorsally the snake is uniform bronze-brown down to the middle of the penultimate row, where a faint black line abruptly demarcates the dorsal colour from a yellow flank stripe. The costal scales where overlapped, exhibit a patch of sky blue bordered with black before and behind. These are usually concealed, but when the snake dilates itself become very conspicuously apparent. The head is coloured like the dorsum above, this hue abruptly giving place to yellow on the side of the face. A very conspicuous, broad, black band behind the eye passes back to the side of the body, and is continued in the whole body length as a conspicuous black line on the edge of the ventrals, bordering the yellow flank stripe below and rendering it specially evident. The belly is uniformly yellow, greyish, or greenish.

It will be noticed that many of the distinctive marks seen in *Dendrelaphis tristis* are absent, *viz.*, the light vertebral stripe, the interparietal spot, and the black margins to the anterior supralabials.

On the other hand, a very distinct, broad postocular band is to be seen in *pictus* passing well down the body, and the light flank stripe, is bordered below by a black line. These colour differences were noted by me 10 years ago on comparing Burmese with South Indian examples, and made me think the two snakes probably different, but I was deterred from declaring my conviction, finding but one difference in lepidosis, *viz.*, the contact of the supralabials with the eye. Since this I have learnt that there is a very noticeable difference between the two in the development of the vertebrals, and still more recently in the dentition.

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* Fascic. Malay. Batrach. and Rept., October 1903, p. 163.

I may mention here that the sky blue adornment just referred to is not of sexual import, since it is to be seen in both sexes from the earliest ages, and at all seasons.

In the Andaman Islands a snake of this genus occurs which has hitherto been considered merely a variety of *pictus*, but which may prove to be a distinct species. It is referred to by Blyth in his book "The Andaman Islanders" (p. 365) as being remarkably rich coloured, green, and variegated, and appears to be common according to this authority. Stoliczka* also speaks of it as being common, and says it is a "beautifully bright yellowish and green during life, each scale blackish in the posterior half." The same authority† says that the usual continental form inhabits the Nicobars, and the Cocos, but the green form is peculiar to the Andamans. It is not however the only form found in this last Insular group, since Dr. Annandale has sent me a specimen very similar to the Burmese form except that the postocular stripe is narrow and obscure, the scales are heavily outlined with black and there is no black line in the flanks at the edge of the ventrals. He remarks that the majority of the specimens from these Islands are of the green variety, *i.e.*, *andamanensis*.

Anderson‡ describes this green variety in greater detail than the other authorities alluded to. He says it is grass-green above, each scale with a broad black margin, and the ventrals with a black margin, as far as the keel. The black margins of the scales, are so broad that when body is at rest, by the overlapping of the scales, the whole side of the body appears black. A black line beginning in the lore reappears behind the eye, and extends to the neck where it becomes broken up into spots.

I have not seen this form in life, but in spirit it appears uniform Oxford blue, acquiring just the same hue that many other green snakes (*Dryophis*, *Lachesis*, *Dipsadomorphus cyaneus*, etc.,) do in spirit owing, I believe, to the green colouring matter dissolving out. The preservative certainly acquires a distinctly greenish tinge. In the specimen I examined only the 5th and 6th labials touched the eye, and the last ventral was divided. If these two characters are constant there is no doubt that the snake should rank as a definite species. A study of the dentition would decide the point.

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* J. A. S. Bengal XXXIX, p. 193. † J. A. S. Bengal XLII, p. 163.

‡ P. Z. S. 1871, p. 184.

Dimensions.—The largest specimen of the typical variety I know of is the one collected by Evans and myself in Rangoon, which measured 4 feet 3 inches.

General characters.—Practically identical with those enumerated under *D. tristis.* I know of nothing special calling for remark; except that the tail appears to be relatively longer than in *tristis*, being usually fully one-third the total length of the snake, and often rather longer. The tongue is red with black tips (Flower).

Identification.—The remarks made under *D. tristis* are applicable here. A combination of the following characters will establish its identity:—(1) Vertebrals enlarged, and as broad as long or nearly so in midbody; (2) Ridged ventral shields; (3) Scales in 15 rows in midbody; (4) Divided anal; and (5) Subcaudal shields 131 to 153. As this snake is by far the commonest of the species in the genera *Dendrophis and Dendrelaphis* within the territory referred to hereafter, it is probable that any snake with the first two characters just mentioned will prove to be *pictus.*

Haunts.—Its haunts are precisely those of its common Indian ally *tristis.* That it will leave its arboreal environment, in quest of food is shown by Flower who found a marsh haunting frog *Rana macrodactyla* in the stomach of one specimen. In Burma it was found in trees, and bushes, in verandah-creepers, the trellis-work screens around tennis-courts, and similar situations usually, and Annandale remarks that in the Malay States it is more usually found in bushes near the ground than in trees.

Disposition.—I believe it is a timid, inoffensive reptile, much like its Indian cousin *tristis.* A specimen I had in captivity was notably so, for when first caught by the tail it did not venture to menace or bite, but merely struggled to escape. In its cage it retired to the furthest part when the glass was approached, and could not be roused to anger by drumming on the glass or waving objects before it.

Habits.—Its springing ("flying") habit is, I think, clearly established. Shelford, who remarked upon this extraordinary habit* mentioned *Dendrophis pictus* as one of the species credited by the natives of Sarawak with the power of springing, and Dr. Annandale writing to me some time back told me that he had witnessed the flight of a *Dendrophis pictus* between two trees in the Malay States, and caught the snake in his butterfly net.

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* Prol. Zool. Soc. Lond., 1906, p. 227.

Food.—The only specimen of eight collected in Burma which had recently fed, contained a tree frog, and Flower has known *Rana macrodactyla*, a marsh frog taken. I suspect that its gastronomic tastes are much the same as those of *tristis.*

Breeding.—I have no breeding events to chronicle from any source.

Distribution. (*a*) *Geographical.*—Variety *typica*, occurs in the Eastern Himalayas about Sikkim up to an altitude of about 4,000 feet, probably the plains of Eastern Bengal, but I am not certain of this, Assam probably,[*] but I am not certain; one specimen I collected I referred with some doubt to this species, the Irrawaddy-Salween Basins (The Andamans, Nicobars and Cocos ?),[†] Indo China, Malay Peninsula, and the Malay Archipelago from Sumatra to the Philippines.

It is impossible to say whether the snake reported by Stoliczka[‡] as common in the Himalayas, in Kumaon and Sutlej is *pictus*, or *tristis.* I have never met with a specimen from the Western Himalayas, and this is the only allusion I can find of such in literature.

I think I am justified in doubting the habitat of Colonel Beddome's specimen in the British Museum said to be from the Anamallays.

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[*] The common species in this province is *proarchos* (Wall) which is described in a paper appearing in this number (p. 827) on the snakes of Assam.

[†] I have lately received a specimen from the Andamans from Dr. N. Annandale. In coloration and markings it was very like *tristis*, except that there was no interparietal spot, and no light vertebral streak. Having prepared the skull I find that it combines the characters of *pictus* and *tristis*, and this being so, I think one has no course open to one but to concede to it the rank of a very closely allied but distinct species. I await further specimens before describing this in detail.

[‡] My reasons for doubting this record are that at least six other Himalo-Burmese snakes are recorded from South India on the sole authority of Beddome; these are *Tropidonotus parallelus*, *T. subminiatus*, *himalayanus*, *Lycodon jara*, *Simotes splendidus*, and *Bungarus fasciatus*. Beddome evidently received snakes from the Eastern Himalayas and Burma because he presented the following snakes to the British Museum from these localities: *Simotes albocinctus*, *S. cruentatus*, and *Dipsadomorphus hexagonotus*. It seems probable, therefore, that the six species first enumerated and also a *Dendrophis pictus* were likewise collected in Burma, or the Eastern Himalayas, and inadvertently mixed with his South Indian collections.

This is the only record of this snake from Peninsular India (excluding Bengal), and until another specimen is forthcoming the record is best ignored.*

Variety.—Andamanensis appears to be peculiar to the Andaman Islands.

(*b*) *Local.*—Variety *typica* inhabits the plains and low hills ascending to a level of about 4,000 feet (Stoliczka says 6,000 feet). It is fairly abundant in the Sikkim Himalayas. In Upper Burma (Bhamo) Anderson reported it common, but two of the three specimens collected by him are obviously the species, subsequently described by Boulenger as distinct, *viz.*, *subocularis.* Evans and I found it by no means common in Lower Burma, acquiring but 6 specimens out of a total of about 750 snakes. In the Malay Peninsula Flower says it is by no means rare, and Annandale and Robinson refer to it as probably the most abundant snake in the cultivated parts of the Malay States. Variety *Andamanensis* is said to be common in the Andamans.

Lepidosis.—The scale characters are so extremely similar to those of *tristis* that I need not repeat what I have said under that species. The two differences that I have been able to discover are (1) that three supralabials, the 4th, 5th and 6th usually, but by no means always, touch the eye and (2) that the vertebrals are as broad, or nearly as broad as long in the middle of the body.

Dentition. (*a*) *Maxillary.*—20 or 21 ; the first 3 or 4 progressively increasing in length, the posterior 3 or 4 decidedly more compressed, but not longer than the preceding. (*b*) *Palatine.*—13 or 14, subequal and as long as the maxillary. (*c*) *Pterygoid* 20 to 26, subequal, smaller than the palatine. (*d*) *Mandibular.*—20 to 22 ; the first 3 or 4 progressively increasing in length, the series then very gradually decreasing posteriorly.

Osteology.—The shape of the nasal bones (fig. B c) is strikingly different from that of *tristis*, so are also the ridges on the parietal bone (fig B d). The length of the articular process of the dentary (B f) equals the distance from the articular notch to about the 8th tooth.

(*To be continued*).

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* J. A. S. Bengal, XL, p. 431.

ON A LOCAL FORM OF THE CHINESE TODDY-CAT TAKEN IN NORTH BURMA BY CAPT. A. W. KEMMIS, BURMA MILITARY POLICE.

BY

R. C. Wroughton.

Paguma larvata intrudens, subsp. n.

A local race of *P larvata* of the Lower Yangtse Valley from which it differs in the exaggeration of the white markings of the head and neck.

Size about the same as in typical *P. larvata.*

Fur rather short (40 mm. on the back), coarse and rather harsh. General colour a buffy shade of 'isabella'; underfur and basal one-third of individual hairs pale drab, median third of latter black, terminal third 'buff.' Face black, a median white stripe from the nose over the vertex to the level of the shoulders, a detached white patch on the back seems to indicate a tendency to a still further prolongation backwards, of this median white line (in an Ichang specimen. this white extends at most to the base of the neck); the usual white spots on the cheeks and above the eyes; the white spot at the base of the ear produced backwards as far as the base of the neck and merging inferiorly into the white throat patch. Ears and chin black. Whole throat pure white. Hands, feet and distal half of tail black. basal half of tail like back, ventral surface whitish, individual hairs on anterior half blackish basally for half their length, bases of hairs on posterior half of belly dirty white.

Skull not differing materially from that of a slightly younger individual from Kiukiang on the Yangtse R., except in being somewhat larger.

Dimensions of the type—Head and body, 600 mm.; tail, 575; hindfoot, 90.

Skull: greatest length, 118; basilar length, 110; greatest breadth, 105; upper carnassial 7·8 × 8·3, first upper molar 8 × 7·5.

Habitat—Sima near Myitkyina—North Burma.

Type—Adult female—B. M. No. 9, 7, 20, 6. Original Number 6. Collected on 19th November 1908 by Capt. A. W. Kemmis.

Burma Military Police, and presented by him to the Natural History Museum.

The Indian type of *Paguma* is *grayi* (and its races) the distribution of which is given by Blanford (Mammals No. 55) as "Throughout the Eastern Himalayas in Assam, Sikkhim, and Nepal and as far east as Simla." The Malayan animal is *P. leucomystax* Gray, and it is therefore most interesting to find the present form of the Chinese *larvata* group in North Burma rather than some form allied to either *grayi* or *leucomystax*.

I would venture to appeal to members serving in Burma to try and obtain specimens and help to solve the question how far south *intrudens* goes before it is displaced by *P. leucomystax*.

PHEASANT SHOOTING ROUND ABOUT HILL STATIONS IN NORTHERN INDIA.

BY

"PINE MARTEN."

Most of the hill stations of Northern India are situated on the lower ranges of the Himalayas, the elevation varying from 6,000 to 9,000 feet. It is the lot of many of us in the Punjab to gather together our belongings at the advent of the hot weather, and having sorted them a bit, pack up a certain portion and track to the hills there to remain for from 5 to 7 months. This exodus from the plains is looked upon with mingled feelings; some think they are in for a bad time and mean to just exist, as far as any sort of amusement is concerned until the next cold weather, when they will be able to return to polo, races, gymkhana, etc.; others mean to enjoy the various diversions there are to be had near at hand in the station itself. A few having to go to a hill station instead of getting leave and roaming in or beyond Kashmir on shikar intent make up their minds to take full advantage of anything that may be had in the way of shikar in their neighbourhood. In hill shooting near a station you will not get much unless you take every advantage of information and go out and prospect yourself before the shooting season commences. In one station there may be only chukor to be shot, but at others there may be a much greater variety, such as leopard, black bear, gooral, karker ("kukur" as the natives call him), pig (there will probably be no rideable country within 20 miles at least) of Pine Marten, whose skins are excellent, if you get at them directly you arrive on the hills in April and again October, kalij and koklass pheasants, and in a few places the beautiful "Moonal" pheasant called by the natives "Leveet," last but by no means least the ubiquitous chukor, the most sporting of the whole lot. I have also shot the true English wood-pigeon* and woodcock, the former I imagine only a winter visitor. I saw one kept in a cage by natives as a pet.

Of the above category the pheasants only are of present interest, so I will first give a brief description of the birds or rather of the kalij and koklass, the "moonal" being too well known, as it is not infrequently seen adorning ladies' headgear or made into screens, etc.

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* The true "English wood pigeon" *Columba palumbus*, is replaced in the Himalayas by the Eastern Woodpigeon, *Columba casiotis*—EDS.

The kalij (*Gennæus albicristatus*) known to the natives as the "cooquer" is a very handsome bird, the two sexes being quite distinct as to colouring. The male (as I have a fully grown young one before me, I will describe him), weight 2 lbs., back green, forehead black, feathers tipped with brown merging into a dull brown crest, the largest feather of which is 1⅝ in. long; the head and upper part of neck have not yet moulted, a red arc round the eye dotted over with tiny black feathers, the arc reaches from the ear to nostril; ear coverts black, lower part of neck wing coverts and over upper part of thorax metallic green. merging into feathers in which the metallic lustre is intensified and each feather having a white border about ¼ of an inch broad; this continues to the tail which is triangular in shape while the bird is at rest, the centre feathers tapering to a fine point and overlying the outer feathers; lower part of neck and chest ashy grey merging into feathers of a darker hue which cover the abdomen. The female has a general olive brown colouring and is also crested. These birds subsist chiefly on the seeds of various wild plants and shrubs, being very partial to the seeds of the wild dog-rose; they also devour grubs, caterpillars and the like.

The kalij, as a rule, lives lower down than the koklass and is a lover of dense cover, and is seldom found far from it, so that when alarmed he may plunge into it, and if pursued scuttles about like a hare turning and twisting and only taking to wing as a very last resort; the young birds of the year rise far more readily, and if they have previously not been molested by man usually perch in a tree emitting a whirring, scolding chuckle as they rise, and generally continuing it for a few moments after alighting. When once in a tree (they usually select the one with densest foliage near at hand) they remain immoveable until either dislodged by a stone, or the sportsman's or one of his assistant's eyes fall on him, and then knowing as if by magic that he is seen, he splutters out of the tree and dashes downwards, almost invariably alighting on the ground. When roused a second time even the young ones usually do not pitch in trees, but make off down the khud.

The old birds are wonderfully cunning in districts where they are at all shot at, instead of perching in a tree they often make off, straight down the khud, steering themselves dexterously between dense cover, or if they elect to perch, which they only do when flushed by a dog, they rise almost noiselessly, and take their departure in the same manner on the approach of man, giving a very difficult snapshot to the gunner, the only result from his point of view being the falling of a few twigs and leaves.

The koklass (*Pucrasia macrolopha*), a far more sporting bird than the kalij and weighing nearly half as much again, lives higher up where the Paludas grow (a species of pine tree, only growing at about 7,000 feet—at least I have not come across them lower down). They are very partial to the courses of streams and small plateaux on the sides of hills. They also live on berries and insects, but get a different variety of each in their more elevated haunts. The two sexes are very dissimilar, the cock-bird being even more handsome than the male kalij; both varieties are crested, but the crest of the adult male koklass is jet black, whereas the crest of the adult of the other is white, the general colouring below is silver grey merging into slatey grey on the back: head and upper part of the neck jet black with a white patch on each cheek. The hen is a much more homely looking bird, the general colouring brown with lighter shades on the under-surface, a sporting looking bird withal and more massive looking than her mate. In the shooting season, the old cocks are almost always found by themselves; the old hens may have their whole brood numbering usually 4 to 8 with them, or sometimes a single young bird, but are seldom solitary. The young birds are often found in couples. In shooting, if your dog puts up an old cock, do not trouble to look for any more birds near him, but if it be an old hen or a young one, make the dog range first above, where the first bird rose, then well to either side, and lastly below. I have never seen either these or the kalij run down hill for any distance.

Now for the description of a day's shooting, when fate was kind, one of the days on which all went well. There is a tremendous amount of luck in the sort of shooting I am about to describe, and a lot of hard work. About 4-30 A.M., I hear a voice which says: "sare char bajee," and it seldom has to be repeated for me at this time of the year, which is October, as previous shooting and prospecting seems to have sharpened my senses; possibly exercise has made my liver a few sizes smaller, hence I am less somnolent. It will not be light until 6 A.M.

but I like to have plenty of time over a light breakfast, as I shall not eat again until 12 noon ; also there is a long tramp before the shooting ground is reached : 5-15, and I am ready for the khud side. My two companions for the day are a sturdy hill native and a little brown and white spaniel, the sort so common among the men in the British regiments in the Punjab. She was selected when six weeks old, and commenced her training shortly afterwards, and is now almost perfect as a gun dog. The brilliant moon which now lights our way as we scramble up a narrow hill-path was not in evidence when I retired to bed at 10-30 last evening, but now it is so bright that even under the trees we are not quite at a loss to follow the narrow path. The hill man goes first, as in spite of numerous tramps of this kind, I know the native of the soil will follow the main path much better than I can, and will lead me to our destination in spite of various cattle tracks that criss cross our road, which is after all only a rather larger cattle track. The average hill native has an eye for hilly country that the British-born ruler of the land will seldom equal in spite of much practice. It is not surprising, as most of us are brought up under widely different circumstances.

In the meantime, we have travelled a long way, and the stars in the East are paling and the moon begins to have a washed-out appearance ; however, we can take it easy now, as we are quite high up enough for the koklass. A few minutes later and the small birds begin to chirp and along the crest of the hill we are on, comes a fresh breeze in fitful gusts, the usual harbinger of dawn at these altitudes. It will die away soon, and in fine weather the leaves hardly stir again until the evening. The breeze brings down a few brown and curled silver birch leaves, making one think of autumn, and I could wish many more of other kinds were down as well.

We push on a bit and reach a small plateau, the head of three nullahs, and now as the light grows stronger, every moment we sit down to listen, hoping to hear the prate, prate of the koklass somewhere below us, and shortly after the wail of the last marauding jackal has died away, far down in the valley below, we hear the longed-for sound, something like, only far softer than that emitted by the bazaar moorghi, when she is looking for a place to deposit her egg, not like the cackle she makes when it is laid. Now we must be as quick as possible, or this will be the only brood we shall hear calling. We hastily look round for the easiest way to them, and then the native beckons me and we make off. He well knows I wish him to keep wide of them until well beneath them, and then work up towards them. In ten minutes we are below them, then we proceed more cautiously down into the bed of the now dry torrent. Here I halt, and turning round, meet the bright questioning eyes of my little spaniel, no need to speak; a wave of the hand and she is off, going at full speed. She makes a cast 100 yards in front of us, and a little above, and then returns going at top speed all the time until reaching a ledge in the middle of the water-course, she suddenly stops and turns. A two seconds' examination of the ground with her nose, and up she goes straight up the nullah bed and is soon lost to sight amidst boulders and overhanging foliage. I hear nothing for a minute, and then yap, yap, with a peculiar intonation that I know means pheasant running ahead of me, as well as if she spoke. The next second there is a whirr of rushing wings, and out dash two birds almost simultaneously. They are straight above us, and must see us immediately they clear the tree-tops, but not a jot do they care, their object is the khud below us, and down they come, straight as a die, with outspread motionless wings. I shoot at the first far in front as I know from experience I shall have to turn my quickest to get a shot at the other. As I turn, the first bird hits a rock by my feet, the second bird was still clear of trees when I fired, but he disappears, but greatly to our surprise we see him again for a second as he tops the trees, moving straight upwards, and then turns over and falls with a crash. This is a bit of luck, for had he not towered we should have lost him. The spaniel has meantime rushed down to us, noses the bird near my feet, and then her eyes follow me. She hears the crash below and is off. I tell the native to follow, as it is far down, and the bird is large for her to carry; but she appears again in a few minutes and lays the bird at my feet, and then lies panting and wagging her tail. I whistle for the native and he returns, and picking up the birds makes his way after me, scrambling up the torrent bed. On reaching the place where the birds rose, I again wave the spaniel forward; she dashes hither and thither for a minute and is then off again towards the crest, and very soon there is another yap, yap, and I get a glimpse of a bird topping the trees and then just time for a snap as he swishes past me, this time between the trees. I cannot hear or see any result, but will look later, as the spaniel instead of returning to me remains above, giving a harsh woof every few seconds.

I know what that means well enough. One of the birds is sitting on the lower branches of a tree probably wondering why this funny looking new sort of jackal is behaving in such an unusual manner, and thinking everything is not as it should be, makes up his mind to join his companions below. I am warned by a flutter and the change in the dog's voice, but before I can get myself into position to shoot, the bird is past me and goes on its way rejoicing. Now, although it is a long way back I do not like leaving the third bird I shot at without having a look round, where he might have fallen, as I was pretty certain I was on him, when I pulled the trigger: so down we go again but all we find are two or three feathers, so we conclude that probably if he fell at all it was far down in the valley below, and I console myself by thinking if he is badly wounded he will make a good meal for some jackal to-night, and not be left long to linger in pain. The sun must be up by this time, but we cannot tell for certain here, as the nullah is on the north side of the ridge. We make our way over a ridge intending to enter the next small nullah, scarcely hoping now to hear birds calling as the time for this is nearly over. However, we are pleasantly surprised, and are soon off after another "snide," fortunately in a splendid place—a small plateau covered with bushes overhung by an almost perpendicular piece of khud.

On coming below the plateau, I rest for a minute for breath, and then push on waving the little bitch forward. These birds have evidently been running about all over the place, feeding, and the spainel clearly shows by her flashing stern, and eager movements that scent is abundant, but she finds a difficulty in hitting off the line. The next second she stops dead before a bush, looking over her shoulder at me, and at my nod dashes in and out, bundles a young koklass which rising ten yards from me makes off, but gets no further than the edge of the plateau, probably as easy a shot as one ever gets at a koklass.

The faithful spaniel retrieves the bird and then returns to the bushes, and after some feathering around, strikes a line for the steep khud side. Up and up she bounds, never missing her footing and never faltering. Now she is lost from view but a second or two later her voice is heard, and almost at once out hurry three birds; the first shot crumples up one as he comes towards me, the second is nearly overhead as I fire, and he goes on apparently unscathed. We clamber up by a circuitous route and arrive at the top of the ridge again and sit there for a minute wondering which will be the best way to go now as the sun is well up and there is no chance of hearing any more birds calling. In the distance we hear the tap, tap of the woodman's axe, and soon a mighty crash denotes that some stately Paluda will no longer grace these mighty forests; but what is of more immediate interest following on the crash there rings out the cry of several male koklass far down in the valley below. The cry is far different to that of the bird found in English coverts. All the same, they respond to the same stimulus as their distant cousins in their western home; for who has not heard the cock-pheasants in a home covert set crowing by a sudden noise, such as the first clap of thunder of a storm.

This determines our way, so down we start until we come to a path my man knows of. The spaniel is encouraged to range chiefly above the path, as if she flushes any birds below they will most certainly escape unshot at. We work along round the valley, but although we know there must be birds somewhere, the little lady cannot find a scrap of scent until after a long search. On rounding a bend, she suddenly makes upwards, and I lose sight of her. A long wait, and then a distant yap: a minute later and a dark form is seen gliding downwards between the trees and curving away towards the side of the nullah. I fire as he comes, but the intervening branches are the only things at all injured, so I swing well ahead and fire again, but only realize as I press the trigger that the bird is putting on the brake hard with the intention of alighting on the side of the nullah. Down rushes the spaniel panting and exhausted, so I show her a pool of water in which she wallows for a moment and then jumps out refreshed and ready for anything, so I put her on the place where I last saw the pheasant, and without hesitation she dashes up and over a ridge dividing this from the next small nullah. I follow round below her hastily; three, four, five minutes pass, and I have visions of her lying beside a dead pheasant that she is too exhausted to carry; but not so; she again gives tongue, and again the wily old bird dashes down. I swing on to him, and continuing the swing, catch him in the open space between two trees, although at the moment of pulling the trigger I could not see him. What a handsome bird and what spurs! Even a game cock might have envied them.

On retracing our steps (this bird had gone back) I notice the rotting trunk of a tree with small pieces of the rotted wood scattered underneath it. I pause to examine it, and the hill man says that is what the pheasant was feeding on, and went further to explain that large insects bore holes in the rotten wood, and the pheasants dig them out and eat them. A further walk along the path and a stiff climb up to the ridge and another cock-pheasant is added to our bag, and yet another got away unshot at ; there did not seem to be anything but solitary old cocks here.

Now for some light refreshment and a rest for a couple of hours in the shade, then I wake my slumbering companion, and we proceed plunging downwards through the jungle, reaching a well-worn path after an hour's tramp.

We have now left the haunts of the koklass. They seldom come as low as this in October, but we shall here find—nearer the haunts of man—the kalij ; we can see the tin roofs of the Gali from whence we started, about five miles away in the distance, and we now wend our way in that direction hoping to pick up a kalij or two on the way. The khud here is broken up into a series of small nullahs separated by sharp ridges ; in the nullahs the vegetation is dense and rank, while on the ridges there are only somewhat stunted fir trees, but the bareness is made up for by the ground being carpeted in places by the blue gentian which grows only on the bare ridges. We now come to a level piece of ground about an acre in extent, in which the forest officer has a nursery of deodars. Into these the little lady makes a dash, and during the next minute or two I am kept busy. Six birds rise almost simultaneously, one comes back towards me and the remainder make off for the khud side. I let go one barrel at the first-mentioned, but he passes on; so quickly swinging round the second barrel is directed at one just as he disappears behind a tree, a lot of leaves fall, and three or four feathers drift out on the breeze ; my man following a hurried direction from me has made his way round and up the khud, as if he heads off the birds that have gone that way, one or two of the young ones may squat in the bushes between him and me. In the meantime two more birds rise and make off to join the rest, but I have got a bit more forward and on better terms with them. However, in stepping forward, one foot sinks into a hole, that was evidently intended for a young deodar, but not occupied. I raise myself on my knee and give the last bird a parting shot. He responds, crashing into a dense brake of wild raspberry and other bushes. The man above now shouts that a wounded bird has run past him, so I scramble up to where he is, getting severely scratched in the process. I put the bitch on the line, but she dashes over a ridge and I again hear her voice and the noise of wings faintly in the distance ; but nothing comes our way, so I whistle her back, scramble a hundred yards higher up than where the bird was last seen, and wave her into a thick tangle of bushes, where she very shortly strikes the right line, and after a tremendous hunt I twice see the bird that has evidently got the outer end of its wing broken—jump into the air to escape the dog. However, she at last catches him, and returns gleefully, as she loves catching a runner better than anything ; she places him at my feet and without a second's hesitation, he is up and off again ; so there follows another chase which ends sooner than the last, and this time I take good care to take the bird from her mouth.

It is no good looking for any of the birds that come this way now, so we retrace our steps, picking up the bird which had lodged in the brambles.

A little later on rounding a spur, a deep densely wooded nullah meets our view, the spaniel plunges into the undergrowth, and shortly after there is a very excited, prolonged yapping, very different to the short note she gives when after a pheasant. I, hoping it may be karker, scramble into a commanding position, and the next second 20 yards below me a male karker bounds into view. I aim well forward and fire, and shortly after hear a gurgling grunt, which tells me the shots have reached their mark. My man arrives on the scene before I do, and "halluls" the pretty little brown fellow. We then hang him up in a tree to be fetched later on and proceed. The sun is now rapidly sinking towards the summits of a distant range, so we hurry on a bit, and I, thinking we shall not find anything else now as this part is very much frequented by natives, unload my gun and hand it to my attendant ; but just before emerging on to the main road where I expect to find my pony, the spaniel makes a sudden rush up the khud, and two young kalijs rise ; one sits in a thick tree vociferating noisily, while the other alights not thirty yards off; the one in the tree clatters out in response to a stone with a tremendous scolding and whirring. I account for him, and then put the dog on the other. He also rises into a tree, making as much noise as his brother. Unfortunately he departs from below me, but only goes about 40 yards the other side of the path and alights again. I follow, but again he moves, and this time he wings his way far down the khud, not giving me a chance. I pursue no further as the dusk is gathering fast, even young kalij are seldom as tame as this. I expect it is owing to their having lived near this frequented path.

We now emerge on to the main road, and I am glad to rest for a few minutes and empty the contents of my Thermos bottle (which the syce has brought) down my throat; meanwhile the "pahari" lays the pheasants out in a row, and goes off to get two men to fetch the karker. I run my eye over the bag, noting the sexes, and as far as I can judge the ages of the birds. The first to attract attention are the two old cock koklass; no doubt about their not being this year's birds. I expect they are birds of 3 or 4 years' old, judging from their short sharp spurs. One of the remaining koklass is undoubtedly an old hen just over the moult. The end of her breastbone hardly gives at all to pressure; the remaining three koklass are birds of the year. The kalij are one forward young cock, one old hen, and one young hen. Such is what I would term at home my modest bag, nine pheasants and an animal smaller than a roe deer, but as shooting goes round a hill station, I am highly satisfied with my one gun, one man and one dog day!

A NEW BLIND SNAKE FROM THE WESTERN HIMALAYAS.

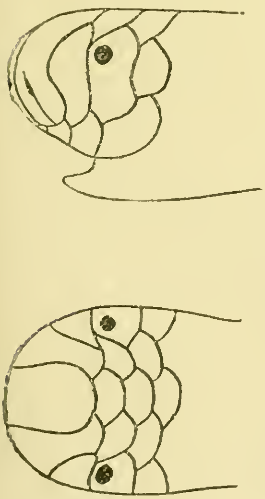
BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Typhlops mackinnoni.

I have lately received from Mr. P. W. Mackinnon, Mussoorie (circa, 6,000 ft.), a single specimen of a blind snake hitherto undescribed which I propose to designate *Typhlops mackinnoni.* It was rescued from the clutches of a fowl which evidently intended to swallow it, but in spite of rough treatment is very little damaged.

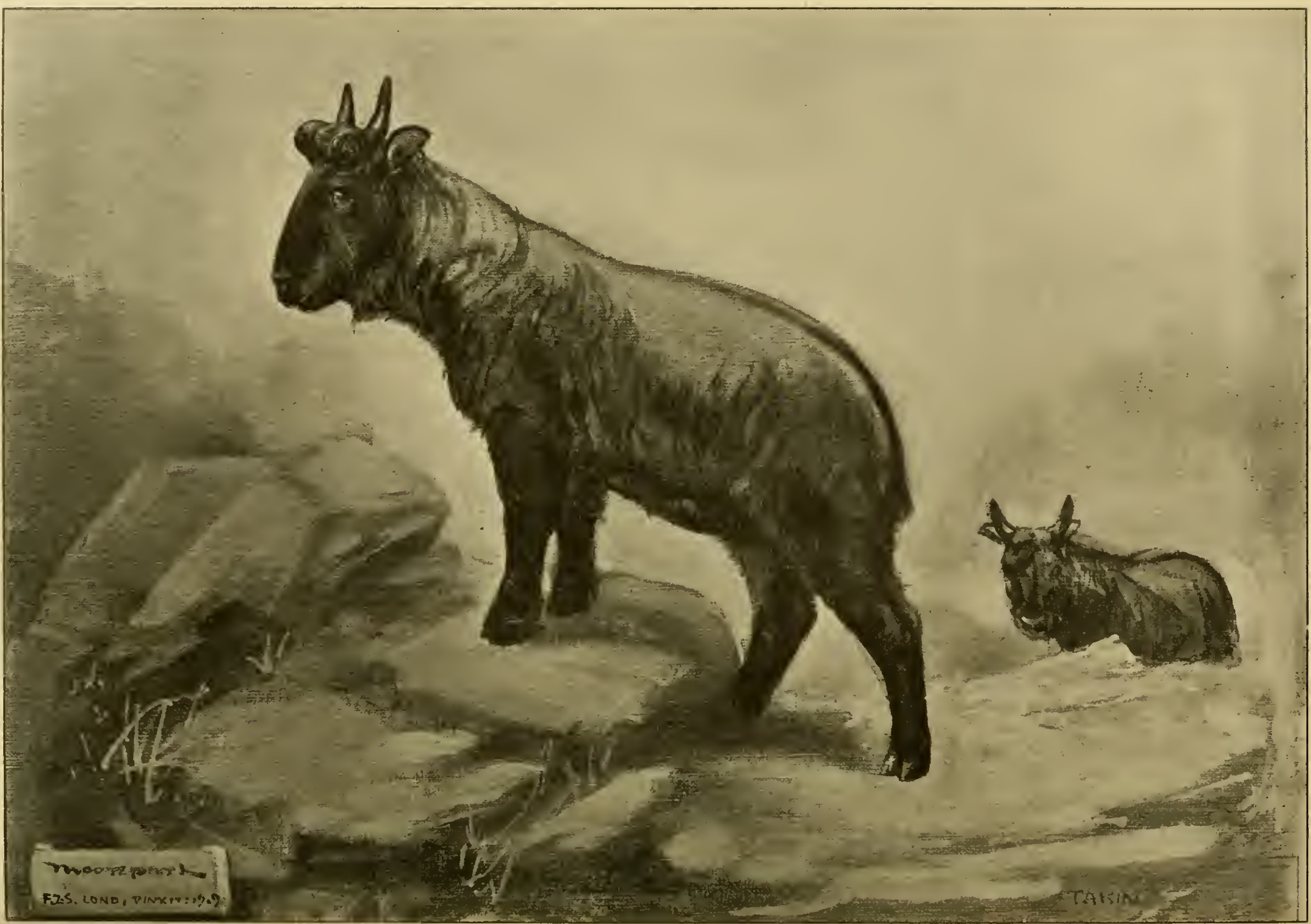
Although the species has up till now escaped recognition, and is only known from this single specimen, I have good reason to believe that it is not uncommon. Five years ago whilst in Mussoorie, the site for a new building was being prepared near the library (circa, 7,000 ft.) necessitating deep and extensive disturbance of the soil. On one occasion I found the workmen had encountered two or three dozen blind snakes in their burrowing operations, and killed them. Most of these, though only some 6 to 8 inches long, were hopelessly mutilated, or cut up into several pieces, but I rescued three or four specimens in good preservation. These I put into spirit, but unfortunately being engaged in other work, set aside, and did not identify, and the bottle containing them was left behind when I packed up. I think it extremely probable that all these specimens were the same as that now described.



Typhlops mackinnoni (spec. nov.) (× 4).

Description.—Length $9\frac{5}{8}$ inches. Snout rounded, and moderately projecting. Nostrils lateral. Eye distinct. Diameter of body one forty-sixth the total length. *Lepidosis. Rostral.*—About one-third the breadth of the head, extending backwards to the level of the eyes. *Nasals.*—Nearly divided, the suture above the nostril fails to meet the rostral, the lower suture passes to the 2nd labial; not meeting behind the rostral. *Præfrontal*, *Frontal*, *Interparietal*, *Supraoculars* and *Parietals* subequal and broader than the dorsal scales. *Præocular* nearly as large as the ocular, in contact with the 2nd and 3rd labials. *Ocular* in contact with 3rd and 4th labials. *Subocular* absent. *Temporal* single. *Labials* four. *Costals* in 19 rows (excluding the ventral row which is subequal to them, in size); decidedly broader than long. A spine at end of tail. *Colour*—Purplish-brown above, lighter below. Chin and mouth white.

It will be seen that the species most closely resembles *T. porrectus* but differs in that the rostral extends back to the level of the eyes, there is a short suture above the nostril and the diameter of the body is $\frac{1}{46}$ the total length (in *porrectus* it is $\frac{1}{70}$ to $\frac{1}{90}$).


F.Z.S. LOND, PINXIT 1909
TAKIN

THE BHOTAN TAKIN (*Budorcas taxicolor*).

THE SEROWS, GORALS AND TAKINS OF BRITISH INDIA AND THE STRAITS SETTLEMENTS.

BY

R. I. Pocock, F.L.S., F.Z.S., Superintendent of the Zoological Society's Gardens, London.

Part I.—Introductory Remarks upon the Structural Characters of Serows, Gorals and Takins and Descriptions of the Known Species of Takins (*Budorcas*).

(*With* 2 *Plates.*)

Serows, Gorals and Takins are three well-marked genera belonging to a group of ruminant ungulates commonly called goat-antelopes from the intermediate position they are supposed to hold between goats and the anomalous assemblage known in popular rather than in scientific language as antelopes. Associated with these three forms are the chamois, which ranges from the Pyrenees to the Caucasus and the so-called Rocky Mountain Goat of North America. It is from the scientific name of the chamois, *Rupicapra*, that this group takes its designation of Rupicaprine Antelopes. Like most of the divisions of Bovidæ, the family containing the Sheep, Goats, Antelopes and Cattle, the Rupicaprinæ are not easy to define, except by the enumeration of a complex of positive and negative features which exclude them from the other divisions. Horns are present in both sexes and are only a little smaller in the females than in the males; they are finely, never coarsely, ridged and having no anterior or posterior crest, and are subcylindrical in section; typically they are short, and comparatively slender, and incline with a backward and more or less outward curvature over the occiput, but in the chamois they are erect, with an abrupt terminal hook. These characters break down more or less in the Takin, in which the horns in the adults are longer, very massive at the base and project at first outward from the side of the head, then form a sudden backward curvature. Nevertheless the horns in the Takin start as simple backwardly directed upgrowths and begin to bend outward and downwards at the base when they are comparable in relative sizes and shape to the horns of the Goral. They then may be said in their growth to go through the stage which persists in the Goral, just as the horns of the Cape Buffalo and of the Gnu pass through in their development a transitory stage which characterises the less specialised kind of horn in the ox tribe in the first instance and of other antelopes in the second instance. The fact that somewhat the same style of horns has been acquired by some Buffalos, by Gnus, by Takins and by Musk Oxen is forming conclusive evidence that the actual mode of growth in horns must not be regarded necessarily as a sign of kinship nor yet as a reason for considering species with different horn-growth as distantly related on that account.

Therefore, coming to the point that concerns us now, since the similarity between the horns of Takins and of Gnus cannot be held to be a sign of affinity between these two genera, so also it cannot in itself be regarded as a sign of affinity between Takins and Musk Oxen nor as a reason for separating Takins from Gorals. Hodgson, it may be added, long ago thought, that the shape of the horns in the Takins pointed to relationship between this animal and Gnus and Musk Oxen.

It is needless in a work of this description to compare Rupicaprinæ in detail with all the other sub-families of Bovidæ that have been instituted. Suffice it that they may be distinguished from the goats, Caprinæ, to which they are probably most nearly related by the absence of the anterior crest on the horns such as is seen in the Markhor (*Capra falconeri*) and the Thar (*Hemitragus jemlaicus*) and of the large knobs on the front of the horn observable in the Himalayan Ibex (*Capra sibirica*). For the rest the Rupicaprines have the ears long or short, narrow or wide. The tail is usually short, but in some Gorals is fairly long and furnished with a long terminal tuft. False hoofs are always present. In external form Serows and Gorals are very much alike apart from size, and no one would guess from their appearance how different they are in the structure of the skulls. Nor would anyone suppose from a comparison of the skins of living specimens that Gorals are not so very remote from Takins, judging from skull characters.

By external features the three would naturally be classified as follows :—

a. Body large and heavy ; legs thick and strong, especially the forelegs below the knee ; ears short with strong rounded upper rim ; summit of the muzzle above the nostrils hairy ; horns arising laterally bent slightly downwards, then sharply recurved, thickened at the base ... ... *Budorcas.*

b. Body strong but light; legs longer and thinner especially below the knee; ears long, much more pointed; summit of muzzle above the nostrils smooth and naked; horns arising on the top of the head and inclined backwards nearly parallel with each other in a direction a little inclined to the plane of the face, gradually narrowed from base to point.

*a*¹. Smaller; no gland on the face in front of the eye ... ... *Nœmorhedus.*

*b*1. Larger; a distinct gland in front of the eye *Capricornis.*

By their skull characters the three genera may be arranged as follows:—

a. Maxillæ and lacrymals forming a long sutural union with the nasals which have a transverse lightly arched, not angular, and deeply emarginate suture with the frontals; lacrymals with a distinct and large pit; profile of skull viewed from above conical the upper rim of the orbits not concealing the zygomatic arch and no decided angulation of the maxilla above the molar teeth. Frontal region and horns as in the Goral (*Nœmorhedus*) ... ... *Capricornis.*

b. Maxillæ not forming a long sutural union with the nasals and almost a small portion of the lacrymal abutting against the nasals so that the angle formed between the maxillæ and the nasals is only remotely separated from the antero-lateral angle of the frontal the suture between the frontals and the nasals deeply and angularly emarginate; no deep depression on the lacrymal bone; skull when viewed from above much less conical in outline in the adult owing to the projection of the orbits which conceal the zygomatic arch and to the presence of a swelling on the maxilla above the molar teeth.

a^1. Frontal and parietal regions of the skull forming an evenly convex curve, the horns projecting backwards and upwards, nearly following the plane of the face and subparallel to each other .... *Nœmorhedus.*

b^1. Frontal and parietal regions of the skull not forming a gentle curve, owing to the presence of a large upright long crest supporting the horns, which project laterally from its sides with a downward followed by a backward curvature .... *Budorcas.*

It may be added that the deep-seated differences between the skulls of Serows (*Capricornis*) and Gorals (*Nœmorhedus*) are to a slight extent bridged over in the Japanese Serow named *Capricornulus crispus* in which only a very small area of the lacrymal touches the nasal, so that the antero-lateral angle of the frontal is not very remote from the upper edge of the maxilla. The latter, however, forms a long union with the nasal and the lacrymal is fitted as in the typical Serows.

A few words must now be added by way of explanation of the generic names adopted in this work. Owing partly to the introduction and sustained use of inadmissible names and partly to failure to appreciate the value of the structural differences between Serows and Gorals, there has been much needless confusion in the generic nomenclature of these two animals. The history of all this confusion would be too long to tell in a paper like the present, especially since I have already set it forth at some length in the Annals and Magazine of Natural History for February 1908. All that need be said is that originally Gorals and Serows were grouped together under *Nœmorhedus* by Hamilton, Smith, Hodgson and others. The first author to distinguish them by generic names was Ogilby in 1836, who called Serows *Capricornis* and Gorals *Kemas* and abolished *Nœmorhedus* which he had no power or right to do since by its original definition it must stand for one of them. Moreover, *Kemas* or rather *Cemas* had been previously employed for a section of ruminant

Bovidæ which did not include the Gorals at all. Hence the name could not be applied to those animals. Quite wisely and reasonably, therefore, Gray, when he revised the group in a series of papers dating from 1843 to 1852, reserved *Capricornis* for the Serows and substituted *Næmorhedus* for *Kemas* for the Gorals. Thus more than sixty years ago the names of these two genera were fixed in strict accordance with all the rules of nomenclature and common sense. A thousand pities was it therefore that Blanford, when writing his classic volume on the Mammals of India, put everything wrong again by ignoring Gray's decision and going back to the point from which this author started, namely to Ogilby. But recognising that *Næmorhedus* must stand either for Serows or Gorals, he abolished *Capricornis*, used *Næmorhedus* instead and reserved the inadmissible name *Cemas* for the Gorals. That Blanford's example was followed by most of his successors is not a surprising thing. But it was not followed by all for the question of the names was confused still further by Mr. Lydekker who in 1900 rightly dropped *Kemas* as inadmissible for the Gorals and wrongly vesiculated a name long consigned to oblivion, namely, *Mortragus*, which was given by Gray in 1871 to the Chinese Goral called *caudatus* by Milne Edwards, a species very closely allied to the one described in the following pages as *Næmorhedus griseus*.*

These few words of introduction on the nomenclature of Serows and Gorals adopted in the following pages are, I think, rendered necessary by the fact that sportsmen and naturalists in India will otherwise be at a loss to understand the reasons for setting aside the nomenclature in Blanford's monograph and also in Mr. Lydekker's Great and Small

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* Although I clearly pointed all this out early in 1908, my friend Mr. Lydekker still adheres to the modified version of Blanford's nomeclature he had adopted (see P.Z. S., Dec. 1908, p. 941) on the pretext that it was justified by duration of use. This argument, coming from the author who had substituted the practically unknown and never previously adopted name *Urotraqus* for the familiar term *Kemas* is a little quaint. Moreover, although I should not admit that the argument had any validity, even if true, it happens to be demonstrably untrue. For *Capricornis* was used exclusively for the Serows in 1836, whereas *Næmorhedus* was not used exclusively for them, so far as I have ascertained, until 1891. Even if, as I suspect, Mr. Lydekker relies upon "frequency" instead of "duration" all that I can say is that the statement may be true or false. I take it that Mr. Lydekker will no more attempt to substantiate it than I shall to disprove it by counting the number of times that *Capricornis* and *Næmorhedus* have been applied exclusively to Serows in zoological literature; but I have a shrewd suspicion that *Capricornis* would come out a long way first since it was used over and over again, in the sense in which I have used it, by that most voluminous writer Pére Heude in the nineties of the last century.

Game of India, the two volumes to which they are most likely to have access for reference. In this paper, therefore, as in my previous ones, I follow Gray in calling the Serows *Capricornis* and the Gorals *Nœmorhedus*. With regard to the generic name *Budorcas* for the Takins there has happily been no difference of opinion amongst authors.

Genus *Budorcas*, Hodg.

Hodgson, Journ. Asiatic Soc., Bengal, xix, p. 65, pls. I—III, 1850: A. M. Edward's Rech. Mamm.

A large heavily built aberrant genus of "goat-antelopes" which by the structure of the skull seems to be an exaggeration rather of the Goral (*Nœmorhedus*) type than of the Serow (*Capricornis*) type. As in the Goral, for example, the face-gland is absent and the lacrymal bone has no pit for its lodgment. Moreover the upper portion of the maxilla between the upper end of the premaxilla and the lacrymal is much narrowed and forms no decided sutural union with the nasal, although almost in contact with it; the nasal itself projects fairly forward from its deeply emarginate suture with the frontal which is separated from the maxilla by a narrow space occupied by a piece of the lacrymal. In other particulars, however, the skull differs considerably not only from that of the Goral but also from that of the Serow, the differences being chiefly due to variations connected with the exceptional size and shape of the horn. Thus instead of forming a continuous curve with the frontal and occipital regions as in the other two genera mentioned, the area between the horns is elevated to form a stout, strong crest, which descends vertically behind them in the direction of the occipital ridge. From the sides of this crest arise the horns which are thickened and nearly in contact at the base where they move outwards, downwards (or forwards), then take an abrupt curve upwards (or backwards) in the same direction as the plane of the face. Viewed from above also the outline of the skull is more Goral-like than Serow-like owing to the prominence of the orbits making a constriction in front of them, and this is followed by another constriction of the maxilla just in front of the upper row of cheek teeth. The shape of the head follows that of the skull, the nasal region being high and erected and the mouth heavy with thick lips. The legs are remarkable for their stoutness, especially those of the front pair, the portion below the knees being exceptionally short and thick; the hoofs are broad and the false-hoofs large; the back is narrow and the abdomen full. The tail is short, broad and bushy. Although the resemblances in external form between Takins, and Serows is obscured by the great thickness of the legs, which are exceptionally short and stout below the knee in the Takins, nevertheless there is an unmistakable similarity between the two in attitude and general form. They stand straight up on the legs with the fetlocks and hoofs almost in line with the cannon bones above them. The head is carried normally with the neck nearly in line with the back, and the line of the back is broken by the slightly elevated withers and by the arch of the spine which rises in the middle of the back to about the height of the withers. From that point however the back slopes right away down to the root of the tail, the croup being very low and the tail set on nearly on a level with the lower edge of the neck when the latter projects forwards. This gives to the hind quarters a characteristic look of weakness which is enhanced by the "cow-hacked" appearance of the hind legs and by the suggestion of dragging about these limbs as the animal walks. Heavily built and entirely lacking the lightness of limb and body to which Serows and Gorals owe their activity, Takins are slow and deliberate in their movements and both ascend and descend rocks in a ponderous manner without any of the spring observable in mountain goats and antelopes. Those features, however, which, apart from the horns, detract most from their likeness to Serows and Gorals are the ears, which, instead of being long and as has been expressed donkey-like, are quite short and broad with a nearly semicircularly rounded upper rim and a much straighter lower rim. Finally the muzzle, instead of being bare, slimy and wet above, at least half way back to the corner of the nostril, is covered with short hair above, only the front of it and the area round the nostrils being naked. Almost exactly similar differences exist between the muzzles of yaks and others of the ox-tribe. It seems probable that the hairiness of the muzzle is associated in these two otherwise widely dissimilar ruminants, with life at high altitudes where the snow in winter has to be scraped away to get at the vegetation beneath.

The above given description of the shape of the Takin has been taken from observation of a living animal, the first brought alive to Europe, which was presented to the Zoological Society by Mr. Claude White, C.M.Z.S., through whose instrumentality it was procured in

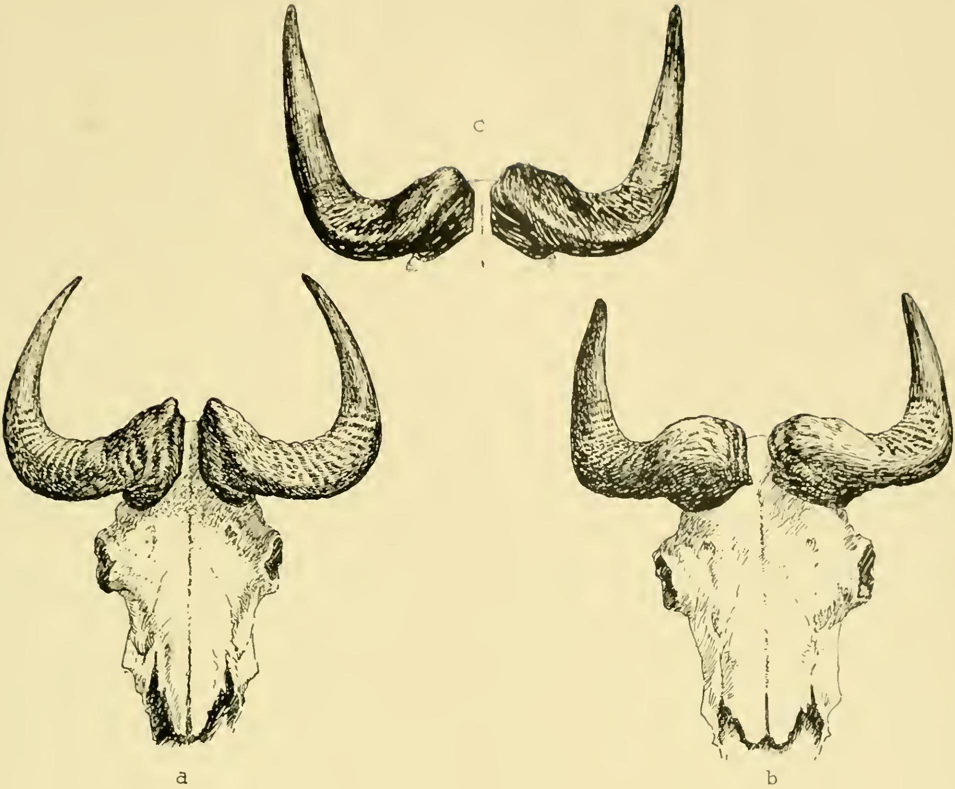
Bhotan. If the description be compared with some published plates representing the full figure of the animal a useful object lesson may be learnt regarding the futility of the efforts to depict the real appearance of an animal from a flat or mounted skin. For instance in the Proceedings of the Zoological Society, 1853, pl. XXXVI, Wolf represents a Takin as a noble looking beast, full of fire and spirit with a magnificently carried head, while in quite a recent number of the same periodical (1908, pl. XLIII), there is a figure of the animal which politeness permits one to describe as a ludicrous caricature. Very much better is Milne Edward's figure in his classic work Recherchers des Memiferès, pl. 74. Indeed so good in the main is this illustration that one cannot but surmise that it was taken from a sketch of the living animal submitted by Père David, its discoverer, to the French zoologist.

Young Takin sometimes differs considerably from the adult in colour. In the species described by Milne Edwards for example, namely *B. tibetanus*, while the adult bull is mostly a golden yellow and the cow grey, the young is fairly uniformly reddish brown, the pale tint being gradually acquired with growth. The heavy thick set build, however, is as manifest in the calf as in the full grown animal. The horns begin to arise, as in cattle, wide apart towards the angles of the forehead and grow upwards and slightly obliquely outwards for several inches before beginning to show traces of an outward bend at the base, which is the first indication of the curvature characteristic of the adult. This process was observed in the young Bhotan individual now living in the Zoological Gardens in London.

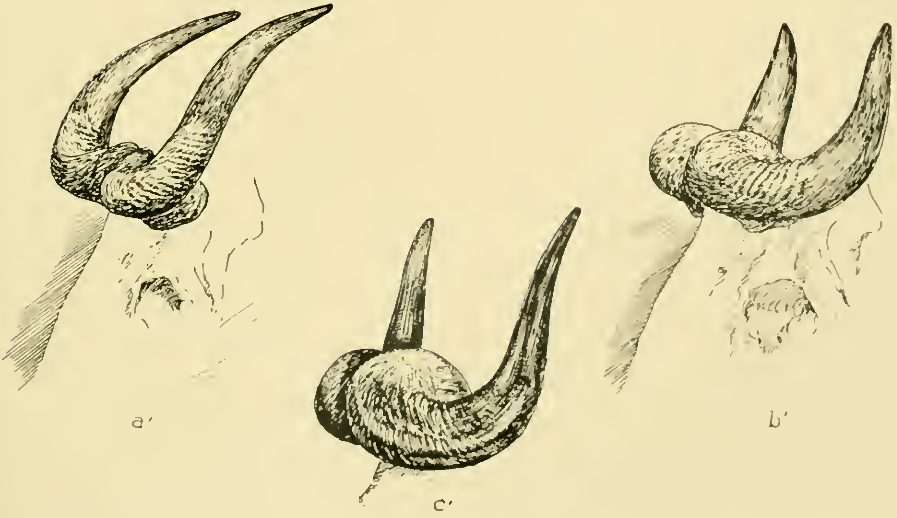
The two species of Takin that have been hitherto distinguished differ as follows :—

a. Head for the most part dark brown or blackish with no definite and isolated black patch on the nose below the eyes ; horns not distinctly ridged in the adult and showing an abrupt upward curvature ... ... *taxicolor.*

b. Head yellow or grey with a very definite and isolated black patch upon the nose below the eyes ; horns, sometimes at all events, distinctly ridged in the adult and more evenly and less angularly curved ... ... *tibetanus.*



Frontal and Side aspects of Horns of Takin
Sze-Chuen a-a' : Bhutan b-b' : Mishmi c-c'



Budorcar taxicolor, Hodgson.

Hodgson, Journ. Asiatic Society, Bengal, XIX, pp. 65-75, pls. I—III, 1850; Hume, Pro. Zool. Society, London, 1887, p. 485, figs. 1-3; Blanford, Mamm. British India, p. 515, 1891; Lydekker, Pro. Zool. Society, London, 1908, p. 796, fig. 168; and of other authors.

The colour of this species is evidently subject to a good deal of variation. According to Hodgson the entire body both above and at the sides is yellowish grey, thus suggesting the name "*taxicolor*" or badger-coloured; but the quantity of grey is variable, the whole animal being sometimes uniformly black owing to the absence of the grey, which results from the basal two-thirds of each hair being of a straw tint with the apical third black. The whole of the head and neck, the greater part of the belly, the tail and legs are black. It seems probable that the difference in the body-colour Hodgson points out is of a seasonal nature. The newly growing hairs showing only their apical third would give a black appearance to the pilage, but as the basal pale portion appeared gradually above the surface of the skin the colour would become at the same time more and more yellowish. This suggestion is borne out by Hume's account. He says the black or blackish heads are constant from kids to the largest males and females; but in some cases the body is yellowish dun, almost as in Milne Edward's plate of *B. tibetanus*, while in others it is deep reddish brown with a great deal of black intermingled, and sometimes intermediate shades occur. Hume adds that in his opinion these differences are not due to age or sex but to season. Both Hume and Hodgson agree that there is no sexual dimorphism in colour, the male and female being alike in this respect.

In the mounted male specimen in the British Museum the head as far back as a line lying behind the horns and ears is blackish brown; while the whole of the neck both above and at the sides, the withers and back half way down the sides and the croup are yellowish tawny or fawn, the tail, the outside of the thigh, the lower half of the body and of the shoulders, and the legs are blackish brown. There is in this specimen a dark spinal stripe extending from the occiput to the root of the tail; but whether the spinal stripe always extends as far forwards as in this example there is not sufficient evidence to show.

The coat is thick and longish and clings to the body, being nowhere distinctly woolly. On the body it measures, according to Hodgson, from 1¾ to 2 inches in length and in the males it forms a distinct crest along the throat, about 3 inches in length, and grows on the gullet in the form of a beard, 5 or more inches long. The height at the shoulders, according to Hodgson, is 42 inches in the male and 36 inches in the female. In both sexes the length of the head from between the horns to the nose is rather less than half the height at the withers.

The horns vary considerably in length as the following table shows :—

Length along Curve.	Basal Circumference.	Between Tips.	Sex.	Authority.
25	13	11½	♂	Ward (largest recorded).
24½	12¾	12¾	♂	Hume.
22½	13½	10¾	♂	
22	13			
20	12	12	♂	Hodgson.
19⅜	11	15	♂	Ward (smallest recorded, but doubtful for the race).
16¼	9	7¼	♀	Hume.
16	9¼			
16	10	8¾	♀	
16	10			
14½	9½	6½	♀	Hodgson.

It must be added that the smallest horns recorded in the table above, as measured by Hume, were regarded by him as belonging to younger males than those of the larger size. There can, I think, be little doubt however that they belonged to females. Hume was evidently puzzled by the growth stages of the horns in this genus, for a frontlet he figured under the belief that it represented the horns of a fine old female, seems to have belonged to a subadult animal with the horns more widely separated at the base than in the other frontlets known to him and without the marked thickening on the brow and much less sharply recurved. Hume did not believe that horns of this type could be converted by growth into those of the other type; but he was not aware that precisely analogous changes take place with growth in the horns of gnus (*Connochœtes*).

In his recent paper on Takins, published in 1908, Mr. Lydekker relied for particulars of Mishmi Hill species mainly upon a stuffed specimen in the British Museum, and did not apparently consult Hodgson and Hume for information as to the colour and other characters. He says, for example, that the precise shoulder height is not ascertainable, although Hodgson records it for both sexes. And one of the characters cited as distinguishing the Mishmi Hills species (*B. taxicolor*) from the Sze-chuen form (*B. tibetanus*) is the absence of distinct beard in the male of the former. Hodgson on the contrary expressly says that there is a distinct mane along the throat and a beard 5 inches long in the male, and this is shown not only in the plate accompanying his description but also in the plate by Wolf, published by Gray (Pro. Zool. Soc., Lond., pl. XXXVI). His description of the colour too applies only to one specimen and gives no idea of the variation with respect to this character upon which both Hodgson and Hume lay stress. Moreover, although he says the horns are stouter in *B. taxicolor* than is *B. tibetanus*, measurements given by Rowland Ward hardly substantiate the statement, as may be seen by comparing the dimensions of those horns of *B. tibetanus* recorded below with those of *B. taxicolor* mentioned above.

The two forms indeed are not nearly so distinct from one another as Mr. Lyddeker's descriptions would lead one to suppose, and it is quite possible that Milne Edwards was after all right in regarding them merely as local races of one and the same species.

As a local race of *Budorcas taxicolor*, Mr. Lydekker has recently described the Takin from Bhotan, naming it *B. taxicolor whitei* in honour of its discoverer, Mr. J. Claude White, C. M. G. (The Field, 1907, p. 887; Pro. Zool. Soc., London, 1908, p. 798, fig. 170). According to the describer the chief claim to distinction of this race rests upon the smaller size of the horns. In the skull of an old bull for example Mr. Lydekker judges that the horns would not have measured when unworn more than 15 or 16 inches along the curvature, whereas in the male of the typical form the length is from about 20 to 25 inches. As the skulls figured by Mr. Lydekker show, this difference in length depends upon the greater shortness of the basal horizontal position of the horn in the Bhotan as compared with the Assamese Takin rather than in the greater shortness of the recurved terminal portion. For instance in the skull of the Assamese Takin figured the extreme length of the basal horizontal portion is just about equal to the greatest inter-orbital width of the skull, whereas in the figured skull of the Bhotan specimen, the basal horizontal portion of the horn is markedly less than the inter-orbital width of the skull, this inter-orbital width being approximately the same in the two skulls. Skulls of young males and females of the Bhotan Takin are correspondingly smaller.

Unfortunately detailed comparison between the skulls of the two races was not possible. The two agree, however, in general coloration, in the darkness of the head and the extension of the spinal stripe from the occiput to the tail. In a young female presented to the Zoological Society by Mr. J. Claude White and now living in the Gardens in Regents Park, the coloration is practically the same as that of the adult bull of the Assamese species mounted in the British Museum—the specimen from which Mr. Lydekker's conception of the coloration of the typical form of *B. taxicolor* was derived—except that there is quite a considerable amount of yellowish brown hairs on the forehead and cheeks, so that there is no sharp line of demarcation between the colours of the head and the neck, such as is seen in the stuffed example in the British Museum. Whether this difference holds good in all cases it is impossible to say without further material wherewith to check it; but considering the great variation in colour exhibited by the typical Assamese Takin, it would be rash to assume constancy in all cases for the coloration of the head noticed up to the present time only in one young female specimen.

Budorcas tibetanus, A. M. Edwds.

Budorcas taxiida tibetanus, A. Milne Edwards, Rech. Mamm., p. 367, pls. 74-79, 1874.

Budorcas sinensis, Lydekker, in Rowland Ward's Records of Big Game, p. 350, 1907, and in Pro. Zool. Soc., London, 1908, p. 795.

Budorcas taxicolor mitchelli, Lydekker, The Field, 1908, p. 790; *id.* Pro. Zool. Soc., London, 1908, p. 797.

Budorcas tibetanus, Lydekker, *loc cit*, p. 797.

Colour of the adult male a rich golden yellow in summer and grey in winter on the head, forequarters and over the greater part of the body, though clouded here and there with iron-grey, and passing into iron-grey or nearly black upon the limbs both externally and internally. Ears and tail blackish; a large black patch covering the lower portion of the muzzle below the eyes. A dark spinal stripe extends backwards from the withers. The female resembles the male to a great extent, but instead of being golden yellow, the colour is decidedly grey. Overlooking the fact that Milne Edwards described the female as grey, Mr. Lydekker described the grey Sze-chuen Takin as a distinct race under the name *Budorcas taxicolor mitchelli.* It should be noticed that the figure of the type published by Milne Edwards represents the legs as black from above the knees and hoofs, whereas in the specimens in the British Museum above described they are iron-grey. There is, however, no properly localized material to show whether this difference has any systematic significance or not. A further point is this. The skull of the Sze-chuen Takin figured by Mr. Lydekker in 1908 (P. Z. S., 1909, fig. 169) is very different from the one shown in Milne Edward's work (pl. 77); the orbits especially and the angle of the maxilla being much more prominent. This, however, may perhaps be accounted for by the difference in age of the two animals, Milne Edward's being much the younger of the two. Lastly, Mr. Lydekker rightly says the horns of the examples of this species in the British Museum are more slender than in the Mishmi Hills species *B. taxicolor.* But the measurements given by Rowland Ward hardly support the view that the horns of all Chinese and Tibetan specimens are thinner than in Assamese examples.

The greatest circumference, for instance, in three specimens from Kansu in China and from Tibet, one of the latter being Pére David's specimen in the Paris Museum, are 11½, 11½, 12¼, whereas the much larger number of measurements taken from Assamese material show the average circumference to be somewhere between 11 and 12¾, one, perhaps a female, being 10⅝ and only one reaching 13. Hence the difference is not very great, even if it exists at all—a fact which suggests that the specimen of *B. tibetanus* in the British Museum which Mr. Lydekker and I have described, would seem to be an example with exceptionally thin horns. The annexed figure of the frontlet and horns of this specimen shows not only that the horns are thinner, more arched and more distinctly ridged in *B. tibetanus* than in *B. taxicolor*, but that the skull itself is considerably narrower in proportion to its width in the former than in the latter.

The full measurements given by Ward are as follows :—

Length along curve.	Basal circumference.	Between tips.	Locality.	Sex.
20½	11½	11¾	Kansu (China) ...	♂
19¾	12¼	12½	Tibet	♂
19⅜	11½	13⅜	„	♂

The name *sinensis* which figures in the synonyms of *B. taxicolor* appears in print for the first time, so far as I know, in Rowland Ward's Records of Big Game, 1907. Since it is there accompanied by measurements, the name must stand if the Takin from the locality mentioned, namely Kansu in China, proves to be racially separable from the one Milne Edwards described. Mr. Lydekker, however, says that the example in the Tring Museum to which the name *sinensis* was first applied is identical with the Sze-chuen specimens he saw described and figured in 1908. If this be so, and if the differences above mentioned that undeniably subsist between the figures and descriptions of the animals described respectively by Milne Edwards and Mr. Lydekker turn out to be of systematic importance, sufficient to justify nominal recognition, the name *sinensis* will have to be retained for those specimens examined by Mr. Lydekker which were shot by Mr. Brooks in Sze-chuen and are now exhibited in the British Museum, as well as for the type in the Tring Museum from Kansu.

According to Milne Edwards the young of this species is brownish red and gradually assumes the pale tint of the adult with advancing years.

These Takins live in Sze-chuen on very steep and wooded slopes of the highest mountains and only leave them at night to feed. In winter they ascend to the very elevated and treeless summits where coarse dry grass is found in abundance on the slopes exposed to the sun. Although usually found alone or in small troops, it seems that in June they collect together in larger numbers. The voice is a deep bugle-like note, and the alarm cry is a loud whistle through the nose.

(*To be continued.*)

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NOTE ON THE SEROW (*NŒMORHEDUS BUBALINUS*) FROM THE CHUMBI VALLEY.

BY

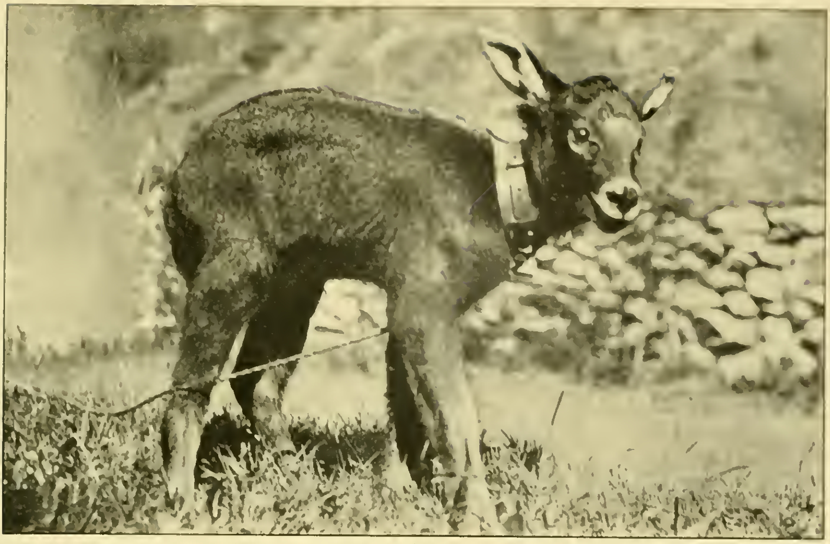
CAPTAIN F. M. BAILEY.

(*With a Plate.*)

The three photographs of Serows on Plate B were taken in the Chumbi Valley where the animal is not uncommon.

No. 1 is of a young animal captured on 16th July 1908. I was only able to keep it in captivity for a short time as it escaped. Nos. 2 and 3 are of an adult male captured on the 22nd April this year. This animal only lived for two days and was very wild and dangerous, making sudden rushes at any one who approached, and striking with his horns which were very sharp. The photographs show the characteristic attitude which this animal adopts; the legs appear to be sprawling about, the clefts in the hoofs are much opened, and the head is thrust forward with the horns lying back along the neck. The skin and skull of the animal in the photograph has been given to the Edinburgh Museum and a description of it by Mr. Pocock, F.Z.S., is to appear in this journal. The following are the measurements of this specimen :—Head and body 52″. Tail without end hairs 4½″, ear 6½″, height at shoulder 34″.

On the 26th June 1907 an adult female was captured, which I was able to keep for about a fortnight, after which she died when giving birth to a single young one. This animal although it would eat from the hand was also very dangerous, and it was unsafe to approach within reach of its tether. The three Serows mentioned above were captured at an altitude of about 10,000 feet. The Tibetan name for the Serow is "Gya-ra."



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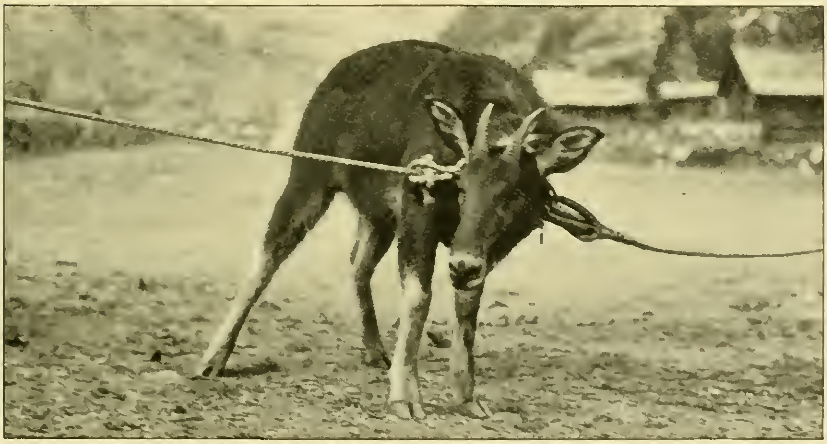

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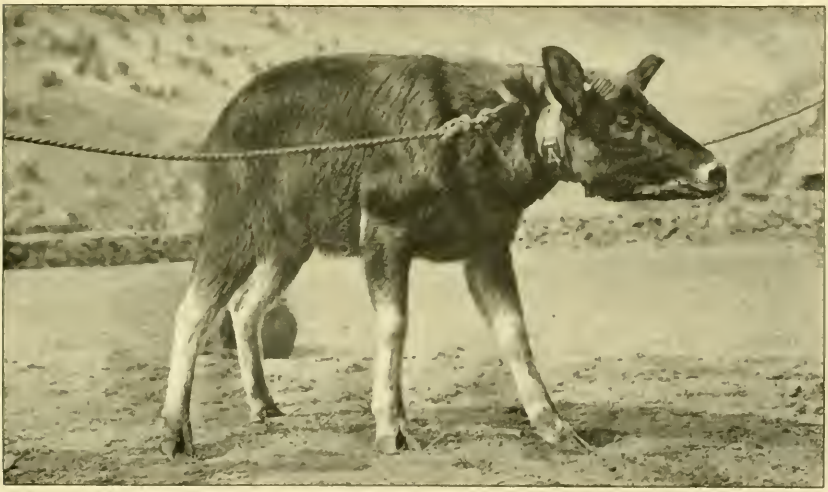


3.

THE HIMALAYAN GOAT-ANTELOPE OR SEROW (*Nemorhædus bubalinus*).

NOTE UPON THE SKIN AND SKULL OF A SEROW OBTAINED BY CAPT. F. BAILEY AT CHUMBI IN TIBET.

BY

R. I. POCOCK, F.L.S., F.Z.S.,

Superintendent of the Zoological Society's Gardens, London.

At the request of Mr. W. S. Millard and of Capt. F. Bailey I examined, at Rowland Ward's in Piccadilly, the skin and skull of a Serow obtained by Capt. Bailey at Chumbi, near Sikkim, at an altitude of 10,000 feet, and now, I understand, exhibited in the Edinburgh Museum. Although the animal appears to me to belong to the same race of Serows as the form described by Hodgson from Nepal as *Antilope thar,* remains of Serows so seldom come to hand for examination that I think a descriptive note of the characters of this animal is worth publishing. I may add that there is an example of Serow in the British Museum from Sikkim which was procured by Dr. Blanford. This animal was correctly identified by Blanford with Hodgson's species and presents practically the same features as Capt. Bailey's example, except that the belly is not white along the middle line. I have reason to think this difference may be a matter of age.

According to the paper I recently wrote upon the Serows of the Himalayas and Straits Settlements, Capt. Bailey's specimen should be called *Capricornis Sumatraensis thar* ; or if any one prefers to regard the Himalayan Serows as specifically distinct from Sumatran and Malaccan Serows, it may be called more shortly *Capricornis thar.*

Prevailing colour black on the head, neck and body, the basal portion of the hairs on the body and the posterior part of the mane white, towards the belly and on the outerside of the thighs the black passes gradually into rufous brown ; a brownish tinge on the backs of the ears and on the sides of the upper lip. The front of the upper lip and the chin white ; the white of the chin passing a short distance back along the lower edge of the jaw but not continued nearly as far as the throat patch which consists of a pair of white spots. The black on the shoulders is continued down the outerside of the foreleg nearly to the knee. Similarly the rufous black hue of the outerside of the thigh up to the root of the tail extends down the outerside of the hind-leg to the hock. The legs below the knees and hocks both outside and inside are dirty white ; on the hind leg the white of the innerside extends upwards to the groin and involves also the front of the leg below the stifle (knee) joint ; innerside of foreleg also whitish up to the breast. Middle line of belly and chest and the whorls of hair on the breast white. Tail black with some grey hair.

Capt. Bailey has kindly supplied me with the following dimensions of the animal before it was skinned :—

Height at shoulder	34 inches.
Length of body and head	52 ,,

Length of tail (without end hair) ... ... 4½ inches.
Length of ear ... ... 6½ „

Skull belonging to the low, flattish type characteristic of Nepalese Serows, owing to the transverse and longitudinal flatness of the frontal bones above the orbits. The following are some of its dimensions in millimetres (25 mm. = 1 inch) as compared with those of a skull from Nepal:—

——	Chumbi.	Nepal.
Length from basi-occipital suture to top of premaxillæ ...	235	241
Width across zygomata	118	128
.. „ maxillæ	87	98
„ between orbits	75	87
Length of frontals along middle line	105	105
„ of nasals along middle line	88	93
Width across nasals	40	47
„ „ premaxillæ (maximum)	50	51
Height from alveolus of molar^2 to top of frontal	90	94
„ „ „ premolar^3 to top of nasal ...	78	84
Length of cheek teeth	94	87
Median length of palate	164	167
Width of palate between last molar	55	52
„ „ „ front premolars	34	38
Width of last molar	13	16
Length „ „	20	20

The horns measure 185 mm. (= 7¼ inches) in length and 120 mm. (= 4¾ inches) in basal circumference.

These measurements show certain differences between the two skulls, but only such as are I think attributable to individual variation or to age. Thus the greater length of the cheek-teeth in the Chumbi specimen which is smaller in almost all respects than the Nepal example is I believe a matter of age. Again it will be noticed that although the posterior width of the palate is greater in the smaller skull, the width of the last molar is correspondingly less, so that the measurement taken to include the molars is almost the same in the two, the truth I think being that the molar increases in width up to a certain point of course with age and the palate correspondingly decreases in width. The flatness of the skull above alluded to is well shown by the measurements taken from the alveoli of m^2 and pm^3 to the summit of the frontals and nasals in a vertical line above them. If these be compared with similar measurements yielded by a skull of Rodon's Serow from Chamba in the Punjab and of the Kashmir Serow from Pir Punjab (see my paper, P. Z. S., 1908, p. 189) the value of the difference will be appreciated.

NOTES ON SNAKES COLLECTED IN UPPER ASSAM.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

PART II. (WITH A PLATE.)

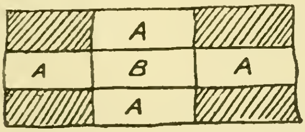
(*Continued from page 623 of this Volume.*)

Coluber prasinus (Blyth).

I had one specimen sent to me from near Jaipur (Namsang).* The ventrals and subcaudals were 191+102. Anal divided. The scales were 19 anteriorly and in midbody, 15 at a point, two head-lengths before the anus.

Coluber radiatus (Schlegel).

One killed by some Assamese boatmen was called by them "goom phitti". I collected 41 specimens, of which 11 were from Sadiya, 2 from near Doom Dooma, and the rest from Dibrugarh. Of 25 specimens sexed 18 were ♀ and 7 ♂. My largest were ♀ 6′-0⅝″, and ♂ 6′-0″. Not only is the colour of the scales remarkable in this snake, but also that of the skin. The head in life is usually a copper colour, or a hue not unlike that of dried orange peel, and this merges to a duller tone on or close to the neck. Anteriorly the body is adorned with black longitudinal stripes, usually three in number on each side, and progressively narrowing from above downwards; the lowest often interrupted. In a slough I found I noticed that these black marks were faintly visible. The skin at this situation is chequered as shown diagrammatically in the attached figure. The shaded squares are pitch black, squares A are a pale blue-grey, and square B bright yellow. The effect is very striking. The tips of the tongue are black. On the 27th April two were reported as having been seen in company playing together. One, the ♀, was killed and proved to be gravid, the eggs being nearly matured. This is yet another instance of the conjugal attachment of snakes, which has come to my knowledge of recent years. The secretion of the anal glands is ochraceous in colour.



One specimen brought in was bleeding profusely from the mouth nd on investigation I found two black leeches in the oral cavity. This snake takes readily to water, and on one occasion my wife and I watched a large one swimming the river towards us. It breasted the current, and though a strong flood was flowing, kept its position very well, facing obliquely up stream, and making for a tangle of bush. On another occasion a gentleman watched one swimming towards his boat from across the river, and when confronted by the boatmen, it proceeded to contest the right of way, and by its truculence lost its life. My informant said that when it landed it raised itself, and expanded the neck in a contrary direction to that of the cobra, and was very strikingly handsome. It is infested with the same parasite that afflicts the *Tropidonotus piscator* and *stolatus*, *i.e.*, the larval tapeworm (*Pterocercus* sp.).

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* See remarks on this locality under *Trachischium monticola*.

Other events, etc., of interest are as follows :—

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
1907.						
April 26th ...	...	$1'\text{-}7\frac{1}{2}''$	..	...	...	
„ 27th .	♀	5′-1″	$11\frac{1}{4}''$	244	87	Contained 5 eggs (4+1) $1\frac{10}{16}'' \times \frac{14}{32}$.
May 2nd .	♂	4′-9″	$11\frac{1}{4}''$	229	88	Killed in native house.
„ 11th .	♀	$5'\text{-}2\frac{1}{4}''$	12″	233	94	
„ 16th .	♀	4′-4″	...	248	...	Tail imperfect. Contained 5 eggs (4+2), $1\frac{15}{32}'' + \frac{14}{32}''$.
„ 24th .	♀	$3'\text{-}9\frac{1}{2}''$	$8\frac{1}{2}''$	248	83	
June 3rd ...	♀	$4'\text{-}7\frac{1}{4}''$	$10\frac{7}{8}''$	247	93	
„ 3rd .	♀	$4'\text{-}10\frac{1}{2}''$	1′-0″	...	...	
„ 8th .	♂	4′-5″	...	...	...	
„ 11th .	♂	$4'\text{-}1\frac{1}{2}''$	$9\frac{1}{4}''$	231	88	
„ 16th .	♀	$4'\text{-}5\frac{3}{4}''$	...	...	...	Tail incomplete Contained 7 eggs $1\frac{2}{12}'' \times \frac{12}{32}''$.
„ 26th .	♀	5′-3″	1′-0″	246	94	Contained 9 eggs, 2″ to $2\frac{1}{4}''$ long.
„ 27th .	♂	5′-3″	...	...	...	
July 12th ...	♂	5′-8″	$1'\text{-}0\frac{1}{2}''$	228	89	

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
1907. July 26th .	♂	4′-11½″	11⅛″	244	92	
Oct. 27th .	♂	6′-0″	1′-1″	...	...	
„ 28th .	♀	5′-6¼″	1′-0½″	250	89	
1908. Feb. 16th .	♀	5′-0½″	11⅝″	240	85	
„ 18th .	♂	5′-0⅝″	11⅛″	236	88	
March 26th .	♀	5′-10½″	...	...	...	
April 13th .	♀	6′-0⅝″	1′-1⅛″	...	...	Contained 12 eggs $\frac{13}{16}''$ × $\frac{5}{16}''$.
May 21st .	♀	5′-0½″		...	...	Tail incomplete. Contained 8 eggs 1¾″ long. The first and last 2$\frac{1}{16}''$ long.
Oct. 22nd .	♂	5′-7″	...	...	...	Killed in a stable. Hair of a small mammal in the stomach.

Coluber porphyraceus (Cantor).

Two specimens; one from Sadiya and one from Namsang, near Jaipur. Both quite typical.

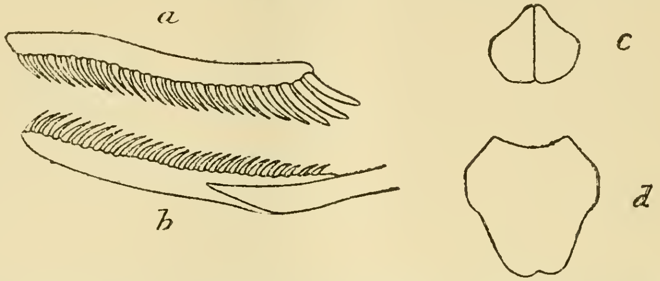
Dendrophis pictus (Gmelin).

I obtained one ♀ specimen of what I think there can be no doubt is this species. The anal is divided, the ventrals 195, and costals 15 anteriorly and in midbody, 9 behind at a point two heads-lengths before the vent.

Dendrophis proarchos (spec. nov.)

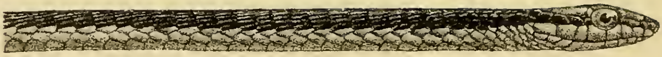
I collected 24 specimens of a snake of this genus which is certainly entitled to rank as a distinct species hitherto not described. With the exception of one from Sadiya, one from North Lakhimpur (Dejoo) and one from near Doom Dooma, all were obtained around Dibrugarh.

The species is extremely like *pictus*, but differs in having the anal shield entire and in the dentition. In no other species of this or the nearly allied genus *Dendrelaphis* is the anal undivided. I have prepared two skulls and the dentition is as follows. *Maxillary* 27 to 28 teeth, the last 3 very distinctly enlarged, even I think more so than in *pictus*. *Palatine* 15 to 16. *Pterygoid* 24 to 27. *Mandibular* 25 to 28.



I have 3 skulls of *D. pictus*, all from Eastern Himalayan specimens. In these the *maxillary* teeth are 20 to 21, the *palatine* 13 to 14, the *pterygoid* 21 to 26, and the *mandibular* 21 to 22. From these data it will be seen that *proarchos* differs very considerably from *pictus*, especially as regards the *maxillary* and *mandibular* teeth. I tabulate the specimens as follows:—

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales			REMARKS
						2 heads-lengths behind head.	Midbody.	2 heads lengths before vent.	
1907									
May 4th.	♀	3′-3$\frac{3}{4}$″	1′-1$\frac{3}{8}$″	190	143	15	15	9	On the roof of a house.
,, 20th.	♀	...	...	..	..	15	15	9	
,, 22nd.	♀	3′-9$\frac{1}{4}$″	1′-3″	192	141	15	15	9	
,, 22nd.	♂	3′-1 ″	1′-1$\frac{1}{4}$″	185	149	...	...	...	
,, 27th.	♀	3′-8$\frac{3}{4}$″	1′-3″	?	141	15	15	9	Contained 7 eggs, 1$\frac{1}{4}$″ to 1$\frac{20}{32}$″.
,, 29th.	♂	3′-5$\frac{1}{4}$″	1′-3″	184	153	15	15	9	
,, 29th.	♀	3′-11$\frac{1}{2}$″	1′-4″	188	146	15	15	9	
June 1st.	♂	1′-5$\frac{3}{4}$″	0′-5$\frac{5}{8}$″	...	. .	15	15	9	
,, 1st.	...	...	...	...	...	15	15	9	Tail imperfect. A gecko in the stomach.
,, 15th	♀	4′-0$\frac{1}{2}$″	1′-3$\frac{1}{2}$″	...	...	15	15	9	Contained 8 eggs, $\frac{23}{32}$″ to $\frac{29}{32}$″ long.
,, 16th.	♂	3′-3″	...	...	...	...	...	...	



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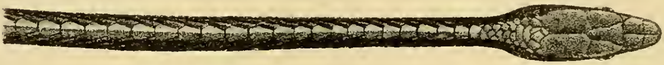

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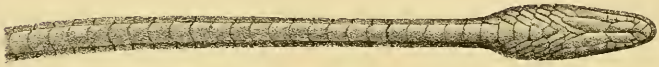

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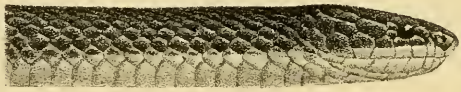

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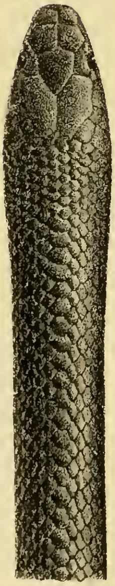

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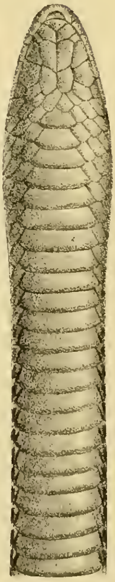

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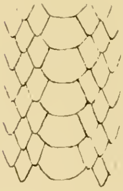

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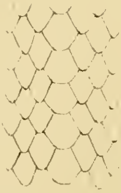

8.

J. Green del. et lith.

1-3. Dendrophis gorei. 4-7. Bungarus niger. 8. B. lividus.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			Remarks.
						2 heads-lengths behind head.	Midbody.	2 heads-lengths before vent.	
1907.									
Oct. 14th.	♂	1'-11¼"	1'-0⅜"	188	148	15	15	9	
,, 25th.	♀	4'-0⅝"	1'-3⅞"	193	...	15	15	9	Tail slightly imperfect.
1908.									
Feb 16th.	♀	3'-4 "	1'-1⅛"	195	142	15	15	9	3 postoculars on both sides.
Mar. 11th.	♂	3'-7¼"	1'-2⅜"	186	143	15	15	9	
,, 25th.	♂	...	...	187	...	15	15	9	Tail incomplete.
April 13th.	♂	2'-8½"	0'-9¾"	...	...	15	15	9	
May 8th...	♀	2'-10½"	0'-11⅛"	...	...	15	15	9	
Sept. 22nd.	♀	...	...	192	...	15	15	9	Tail incomplete.
Oct. 24th.	♂	...	...	187	...	15	15	9	

Dendrophis gorei (spec. nov.)

(Figs. 1 to 3 of Plate).

I acquired two specimens of a new species of Dendrophis. One of the types I sent to the British and the other to the Indian Museum. The first specimen I had sent to me by Mr. C. Gore from Jaipur (Namsang).* It was a ♀, measuring 2 feet 8½ inches, the tail accounting for 10½ inches. The second was from near Dibrugarh (Atabari), and was 2 feet 4½ inches, the tail (8 inches) being imperfect. I found a gecko in the stomach.

Description.—*Rostral.*—Touches 6 shields, the rostro-internasal and rostro-nasal sutures subequal, and about twice the rostro-labial. *Internasals.*—Two ; the suture between them ¾ to ⅘, that between the præfrontal fellows, ¾ to equal to the internaso-præfrontals. *Praefrontal.*—Two ; the suture between them rather greater than the præfronto-frontal ; in contact with the internasals, postnasal, loreal, præocular, supraocular and frontal. *Frontals*—Touches 6 shields ; the fronto-supraoculars more than twice the fronto-parietals. *Supraoculars.*—As long as and rather broader than the frontal along a line connecting the centres of the eyes. *Nasals.*—Divided; subequal; in contact with the 1st and 2nd supralabials. *Loreals.*—One; as long as the two nasals. *Præoculars.*—One, nearly touching the frontal. *Eye.*—Large, equals its distance to the anterior edge of the nostril. *Postoculars.*—Two. *Temporals.*—One anterior. *Supralabials.*—8, the 4th and 5th touching the eye. *Infralabials.*—6, the 6th very long, equalling the 4 preceding shields taken together; in contact with 2 scales behind. *Sublinguals.*—Two pairs, the posterior longer than the anterior; and in contact with the 5th and 6th infralabials. *Ventrals.*—193 to 199. *Anal.*—Divided. *Subcaudals.*—132? (perhaps very slightly docked). *Costals.*—Two heads-lengths behind the head 13, midbody 13, two heads-lengths before the anus 11. The rows reduce to 11 by a coalescence of the 4th and 5th rows above the ventrals. *Vertebrals.*—Very well developed, as broad as long in midbody, as broad or broader than the last row. *Body.*—Cylindrical. *Colour.*—Very like *pictus.* Dorsally bronze-brown ending abruptly in the middle of the penultimate row, the overlapped margins of the scales a bright sky-blue. A lighter vertebral stripe. Belly, ultimate and lower half of penultimate rows greenish opalescent. Head ruddy-brown above with a well defined black postocular streak continued on to the forebody. Lips and chin greenish-opalescent. *Dentition.*—For fear of damaging the specimens, I only investigated the maxillary teeth. I counted 20 on the right side, the last 2 or 3 of which appeared to be slightly longest.

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* For remarks on this locality see *Trachischium monticola.*

Dendrelaphis biloreatus (Wall).

The type specimen, the only one collected, came from Sadiya, and was described and figured in this Journal (Vol. XVIII, p. 273). It is now in the British Museum.

Simotes albocinctus (Cantor).

Nine specimens came to bag. Three were from near Dibrugarh (Maijan and Greenwood Estates), one from North Lakimpur (Dejoo), one from near Tinsukia, three from Sadiya, and one from near Jaipur (Namsang), all of these belonged to variety *typica* (A of Boulenger's Catalogue). In the Jaipur specimen the subcaudals were 47, in the one from Dejoo 49, and in the one from Maijan 50 (Boulenger 51 to 69). A ♀ measuring 2 feet $5\frac{1}{4}$ inches (the tail imperfect 4 inches) was gravid on the 10th of July and contained 3 eggs. The supralabials were 8, the 4th and 5th touching the eye in one specimen.

Simotes violaceus (Cantor).

Only two examples were obtained, one from near Tinsukia, and one from near Halem (Baroi). Both belong to variety D of Boulenger's Catalogue (Vol. II, page 223). In both the ventrals and subcaudals were 177 + 31 (Boulenger: subcaudals 33 to 41). In one there was a small median præfrontal.

Oligodon dorsalis (Gray).

A single specimen was sent me by Mr. Gore from Namsang, W. Jaipur. This was a ♀ 12⅝ inches long, the tail being 1½ inches. The ventrals were 173 and the subcaudals 29. The scales two heads-lengths behind the head were 15, in midbody 15, and two heads-lengths before the anus 13, as is usual in this species.

SUB-FAMILY—HOMALOPSINÆ.

Hypsirhina enhydris (Schneider).

One specimen from Dibrugarh was brought in to me, a ♂ 1 foot 10 inches long, the tail 5¼ inches. It agrees with variety B of Boulenger's Catalogue* (Vol. III, p. 7). The ventrals and subcaudals were 153 + 74. The costals were in 23 rows at a point two heads-lengths behind the head, 21 in midbody, and 20 at a point two heads-lengths before the anus. The 3rd and 4th rows above the ventrals blended at both steps reducing the rows from 23 to 19.

SUB-FAMILY—DIPSADOMORPHINÆ.

Dipsadomorphus gokool (Gray).

I got four examples of this uncommon snake, three in Dibrugarh, and one from North Lakimpur (Dejoo). One of these was brought alive, and behaved just like others of the genus with which I am acquainted. All are very plucky snakes. This one coiled itself in the typical figure of 8 fashion, and erected itself and poised, thus awaiting an opportunity to strike at me, quivering the tail with anger.

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* I may here mention that I received a similar specimen lately from Champaran (Behar) from Mr. H. Reid. This locality zoologically is part of that with which this paper deals. The costals were 25, 21, 21, in the three sites corresponding to the above. The ventrals and subcaudals were 158 + 59. The stomach was much knuckled and thickened, and full of nematode worms which I think were *Kalicephalus willeyi*.

It struck out several times, but I find that if one is on the alert with these snakes, one can see and evade the stroke, so that it cannot be considered very rapid. With many snakes on the other hand one has no chance of avoiding the stroke, such for instance as *Tropidonotus piscator* and *Echis carinata.*

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			REMARKS.
						2 heads-lengths behind head.	Midbody.	2 heads-lengths before vent.	
1907.									
Mar. 25th	♀	2′-4½″	5¼″	224	87	21	21	17	
Apr. 12th	♀	2′-10½″	6⅞″	227	93	21	21	17	Supralabials 9, the 3rd, 4th, 5th and 6th touching the eye on left side.
......	♀	......	......	227	96	21	21	17	Two præoculars. A mouse in stomach.

It is to be noted that the scales posteriorly reduce to 17 which is remarkable, as many of the species of this genus have 21 scale rows in midbody, and in all except this they reduce to 15. I have now examined 10 specimens, and in only one did the scales reduce to 15. The absorption of rows is the same as in the other species. The scales become 19 by the absorption of the uppermost into the vertebral and very shortly afterwards the 3rd and 4th rows above the ventrals coalesce.

Dipsadomorpus cynodon (Boie).

A single specimen was seen to fall (or spring ?) from a palm tree about 20 feet high in Dibrugarh and was pursued and killed. It conformed to variety* B of Boulenger's Catalogue

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* I may here remark that last year I obtained two well grown examples of this snake from Mr. Jacob from Jalpaiguri, which is in the same Tract zoologically as that to which this paper refers. They were of the same variety as my Assam specimen and agreed with it in the lepidosis just referred to except that the ventrals and subcaudals were 255 + 126 and 256 + 123. The absorption of the costal rows agreed except that in the step from 19 to 17, the 4th row above the ventrals was absorbed into one of the adjacent rows. Mr. Jacob wrote that one of these specimens was being attacked by a banded Krait (*Bungarus fasciatus*), and he shot the latter and then killed the former

(Vol. III, p. 79). It was a ♂ measuring 4 feet 9 inches, the tail being 1 foot 1⅝ inches. The ventrals and subcaudals were 248+119. The scales at a point two heads-lengths behind the head were in 23 rows, at midbody 23, and two heads-lengths before the anus 15. The reductions from 23 to 21 and 17 to 15 were due to the absorption of the uppermost row into the vertebral, and that from 19 to 17 to the absorption of the 3rd row above the ventrals into the 2nd on the right side, and the 4th on the left. All three steps occurred close together.

Dipsadomorphus quincunciatus (Wall.)

The type was described and figured in this Journal by me last year (Vol. XVIII, p. 272), and was sent to the British Museum. Since this I acquired a second specimen from the same locality, *viz.*, near Tinsukia (Rangagara). This is now lodged in the Indian Museum.

It measured 3 feet 5½ inches, the tail being 9¾ inches. It agrees perfectly with the first example except that the ventrals and subcaudals are 237 + 118, and the supralabials are 8, the 3rd, 4th and 5th touching the eye on both sides.

The anterior palatine teeth are barely if at all enlarged.

Psammodynastes pulverulentus (Boie).

In all five specimens were acquired, three from Dibrugarh, one from North Lakhimpur (Dejoo) and one from Jaipur. One of these was the gravid ♀ reported in this Journal (Vol. XVIII, p. 204), which showed that the species is viviparous. I had live examples. The one I kept some time in captivity was a truculent creature. It struck at Captain Wright to whom I was indebted for the specimen, and subsequently struck at me on more than one occasion, wounding me once in the finger when handling it. Prior to striking, it erected itself and threw the forebody into a figure of 8, much in the same way as the *Dipsadomorphus* do; another which my wife encountered at dusk erected itself, and would doubtless have struck if given the chance. I could not get my caged specimen to eat, though I supplied it liberally with small frogs every day. A frog too had been swallowed by one specimen that was brought to me dead. In the flanks there are blotches of bright ochre, and velvety blac which come prominently into view when the snake dilates itself. The dentition in my skulls is as follows :—*Maxillary* 2 or 3 small teeth followed by 2 large and fang-like ; succeeded by 5 or 6 small and subequal, and then 2 large, grooved, obliquely placed, fang-like teeth.

Palato-pterygoid, 8 to 10 + 22 to 25 ; small, subequal. *Mandibular* 2 or 3 small followed by two large and fang-like ; then 13 to 16 small teeth.

Dryophis prasinus (Boie).

Of six specimens, one was captured in Dibrugarh, one in Sadiya, one near Jaipur (Namsang), and three in North Lakhimpur (Dejoo and at foot of Duffla Hills). The Dibrugarh, Sadiya and Dejoo specimens were green, *i.e.*, *forma typica*, the rest buff, or drab colour. This latter is a distinct colour variety, which appears to have escaped being christened. I propose for it the name *flavescens*.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			REMARKS.
						2 heads-lengths behind head.	Midbody.	2 heads-lengths before anus.	
1908 End of March or early April.	♀	5′-7″	1′-7⅞″	205	167	15	15	13	Buff variety, N. Lakhimpur. Contained 3 eggs, 1$\frac{5}{16}$″ × $\frac{7}{16}$″. 4th right supralabial divided.
?	♀	...	...	205	155	15	15	13	Buff variety. N. Lakhimpur.
April	♂	3′-9¾″	1′-5″	203	173	15	15	11	Buff variety. Jaipur.
May 31st	♂	3′-6¼″	1′-3¼″	200	174	15	15	11	Green variety. Dibrugarh. A gecko in stomach.
?	♂	...	...	201	171	15	15	11	Green variety. Sadiya. The 3rd subcaudal entire.
?	♂	...	...	209	159	15	15	11	Green variety. Dejoo. One loreal only on left side ; loreals 2 (1+1) on right side, both confluent with subjacent labials.

In the eggs noted above, though so large, there was no trace of embryos. It will be noticed that in the ♂ the costals reduce posteriorly to 11, but in the ♀ only to 13. This is no coincidence, for

I find referring to many specimens I have examined from Darjeeling and Burma that this appears constant.

The dentition in my two skulls does not appear to agree quite with Boulenger's figure of *D. mycterizans* (Catalogue Vol. III, p. 177).

Maxilla.—6 or 7 progressively lengthening teeth from before backwards, then a short interspace followed by 3 or 4 minute teeth, then a second gap followed by two large, subequal, grooved, fang-like teeth. (In Boulenger's figure two *suddenly* enlarged fang-like teeth succeed six small subequal ones in the front of the jaw.) *Palato-pterygoid* 10 + 20 or 21, small, subequal, slightly reducing posteriorly. *Mandibular* 5 or 6 rapidly increasing posteriorly; then a short gap followed by, from 12 to 14, small subequal teeth.

SUB-FAMILY—ELAPINAE.

Bungarus fasciatus (Schneider).

I acquired 22 examples. Two were from near Doom Dooma, one from near Tinsukia, one from North Lakhimpur at foot of Duffla Hills, and the rest from just around Dibrugarh. Of 11 sexed 5 were ♂, 6 ♀.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
1907.						
Apr. 11th	...	2′- 0½″	2¼″	231	33	
June 12th	♂	2′-10¼″	..	221	36	
„ 18th	♀	4′- 1½″	...	229	24	A snake (*Tropidonotus stolatus*) 1′-9¼″ long, lying at full length in gullet and stomach.
„ 21st	♂	4′- 5″	...	230	38	Stomach full of scales and ventrals of a snake otherwise completely digested. Killed in the act of swallowing a snake (*Zamenis korros*), 4 feet 2½ inches long.
„ 23rd	♂	3′-11⅛″	4½″	229	35	
July 2nd	♂	4′- 0½″	5⅛″	224	38	Ventral and costal scales of a snake recovered from the fœcal contents of cloaca.
„ 13th	♀	3′- 0¼″	...	231	...	Tail incomplete. Reported in water, and in the act of swallowing a fish. Ventral and costal scales of a snake recovered from fœcal contents of cloaca.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
1907. Oct. 18th	♀	3′- $8\frac{1}{2}$″	$3\frac{7}{8}$″	229	33	Found in disused well. 2 temporals on left side.
Nov. 23rd	...	...	...	...	...	Killed at night outside bungalow ; a skink (*Mabuia multifasciata*) in stomach.
„ 28th	♀	3′- $9\frac{1}{4}$″	...	230	35	
Dec. 3rd	♀	4′- 0″	...	...	...	
1908 Apr. 13th	♂	4′-$11\frac{3}{4}$″	$5\frac{5}{8}$″	227	37	5 eggs in the stomach are without doubt snake's eggs and measured $\frac{15}{16}$″ long. 3 of these were quite undamaged.
„ 4th	...	...	...	...	...	Killed in house at night.
May 20th	...	...	...	...	...	Captured alive and sent to Parel.
Oct. 28th	♀	3′- $3\frac{1}{4}$″	...	...	...	Killed in syce's hut.

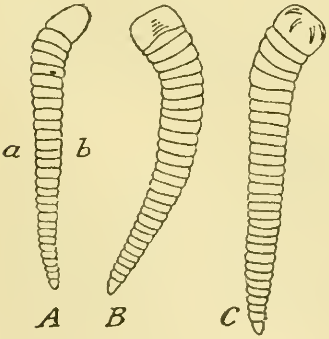
A large specimen preserved in a bottle was sent to me in the act of swallowing a snake (*Zamenis mucosus*). The tail and about 2 inches of the body were protruding from the mouth. The tail measured 1 foot $4\frac{3}{4}$ inches, indicating that the dhaman was about 5 feet in length. Mr. C. Gore told me that the first specimen he ever saw in Assam was in the act of swallowing another snake which was grasped in the middle of the body, and was struggling for liberty. He also told me that he once knew this snake to bite a bullock which died about 20 minutes or so later. Major Leventon, I. M. S., told me that he once killed a gravid ♀ at Sibsagar, which measured 6 feet $1\frac{1}{2}$ inches. Unfortunately he could not be certain of the date.

This snake like all the other Kraits with which I am acquainted is singularly lethargic, and most difficult to anger. I had many brought to me alive, and had ample means of observing its disposition. I did my utmost to provoke one to strike but could not. It simply lay where it was, and made no attempt to escape. When irritated it hid its head beneath its body. When taken by the tail, and roughly shaken, it simply flattened itself, and then buried its head again beneath the body. When a stick was thrust quickly at it, it merely avoided the thrust and when advanced towards it slowly, it retracted itself leisurely. Another large one was brought to me at my hospital by several urchins, who carried it balanced over a stick with the result that every few yards it fell off, but it made no attempt at escape and allowed itself to be taken up and dropped again and again. I watched this noisy band of urchins for some minutes advancing up the road. I then took it by the tail and carried it 300 yards or so home, and worried it in every way to try to get it to strike, but it merely hid its head beneath its coils and lay before me unconcerned. Other specimens behaved similarly.

Its movements are very slow, at any time, and it frequently happens that the planters, who own motor cars, drive over them on the roads at night. The specimen which was disturbed whilst eating a fish is reported to have made off, and climbed a tree to the height of some 10 feet or so. It was knocked off by a lathi and killed.

The secretion of the anal glands is blackish, reminding one of mercurial cream in appearance and consistency. The eye is black as in other kraits, the pupil not being visible.

This like many other snakes is very much infested with parasites. I found two different nematode worms in the stomach, which Dr. Annandale had identified for me as *Kalicephalus willeyi*, and larvæ and immature forms of a species of *Ascaris*. There were many tape worms too in the abdominal cavity usually convoluting themselves beneath the lining membrane. These are larval forms of a species of *Pterocercus*. The maggot-like parasite *Porocephalus brotali* was also frequently found in the abdominal cavity (see figure attached).



Porocephalus brotali, (×8.)
A. Profile (*a*) dorsal (*b*) ventral borders.
B. Dorsal aspect.
C. Ventral aspect showing hooklets.

Dentition.—I cannot agree with Boulenger's description of the fangs (Catalogue Vol. III, page 365), which he says are grooved in this genus. He seems to suggest that the fang is not tubular, but as far as I am aware the fangs of all poisonous Indian, I may say, Asian, snakes are tubular. On the anterior face of the fangs there is a shallow groove, which is the seam marking the spot where the circumflexed walls of the canal have become blended.

The *maxilla* has two moderate tubular fangs placed anteriorly side by side (unless one has been shed). These are grooved on their anterior faces. Behind these are (3 or 4) small subequal teeth, which are grooved on their outer faces. *Palato-pterygoid* 12+11 or 12, small, subequal, grooved on their inner faces. *Mandibular* 16 or 17, small, subequal, and grooved on their outer faces. It will be noticed in each case that the grooves are on the face opposite to the side occupied by the sac or tract, as the case may be, from which the fang or teeth are produced.

Bungarus lividus (Cantor).

I had one specimen sent to me from Bindukuri near Tezpur by Mr. A. E. Lloyd. This is much the largest specimen I have ever seen measuring 3 feet 2 inches, the tail 3¾ inches. The ventrals and subcaudals were 215+37. The vertebrals were but slightly enlarged, the length at midbody distinctly exceeding the breadth. Mr. Lloyd told me he had had the specimen some 12 years, hoping some day to meet some one who could tell him what it was. It had bitten a cooly woman on his Estate at about 10 o'clock one night whilst she sat under the eaves of the verandah of her hut eating her evening meal. She was conscious the next morning, and spoke in answer to the questions put to her concerning her accident. She died some time during that day, the hour he does not remember. Unfortunately no records of her case were available after this long lapse of time.* (Compare the Vertebrals in fig. 8 of our plate with those of *B. niger* in figure 7).

Bungarus niger (spec. nov.)

(Figs. 4 to 7 of Plate.)

I have already referred to this Krait as a definite and valid species apart from *lividus*,† but as yet have not published a description in detail. I collected 9 specimens, 7 in Dibrugarh, 1 from Sadiya, and one from Jaipur.

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* I may here record the receipt of a specimen of this Krait from Jalpaiguri from Mr. Jacob, I.F.S., since this locality is zoologically part of the Brahmaputra Valley. This specimen was a young one measuring 1 foot 1¼ inches. The ventrals and subcaudals were 212 + 39 The vertebrals were but feebly enlarged.

† Poisonous Terrestrial Snakes of our British Indian Dominions, 1908, pp. vii and 19.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals	REMARKS.
1907.						
...	...	2′-9″	...	225	53	Old spirit specimen.
April 23rd.	♂	3′-4$\frac{3}{4}$″	5$\frac{7}{8}$″	229	54	
May 17th.	♀	2′-5″	4$\frac{1}{4}$″	224	52	Found in a well.
June 18th.	♂	4-0$\frac{1}{2}$″	6$\frac{7}{8}$″	216	51	
?	?	...	...	...	...	Head and forebody from Sadiya.
Oct. 17th.	♂	3′-3$\frac{1}{4}$″	5$\frac{1}{2}$″	223	53	Killed in a grain godown in the bazaar at night.
1908.						
June 1st...	♂	3′-10$\frac{3}{4}$″	6$\frac{3}{4}$″	221	55	
,, 17th.	♂	3′-8″	6″	222	51	Killed at night, passing through chowkidar's feet.

The snake is very much like *lividus* with which it was confused by Sclater*. I have examined two of the three examples he referred to which prove to be examples of *niger*: the third probably a true *lividus* is no longer in the Indian Museum. I have now examined 18 specimens of *niger*, and 13 of *lividus* and find that in the former the vertebrals are broader than long in the middle of the body, and the ventrals and subcaudals are more numerous. In the latter the vertebrals are but slightly enlarged on the body. Our artist has shown them distinctly broader than is actually the case in figure 8 of our Plate. In all my specimens the length of these shields exceeds the breadth at midbody. As in other Kraits the eye in life is quite black so that the pupil cannot be seen. The tongue tips too are white. The secretions of the anal glands is black.

Description—Rostral.—Touches 6 shields; the rostro-internasal and rostro-nasal sutures are subequal, and fully twice the length of the rostro-labials. *Internasals.*—Two; the suture between them is about half that between the præfrontal fellows. *Præfrontals.*—Two; the suture between them is rather greater than the internaso-præfrontals; in contact with internasals, post-nasals, præoculars, supraoculars, and frontal. *Frontal.*—Touches 6 shields, the fronto-parietals rather the longest. *Supraoculars.*—Length about $\frac{3}{5}$ to $\frac{2}{3}$, the frontal, breadth less than $\frac{1}{2}$ the frontal along a line connecting the centres of the eyes. *Nasals.*—Divided; in contact with 1st and 2nd supralabials. *Præocular.*—One, barely reaching crown. *Postoculars.*—Two. *Temporals.*—One; in contact with the 5th and 6th supralabials.

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* Journal, As. Soc., Bengal, Vol. LX, p. 246.

Supralabials.—7 ; the 2nd narrowest, distinctly more so than the 1st and 3rd ; the 3rd and 4th touching the eye. *Infralabials.*—4 ; the 4th largest, and in contact with two scales behind ; the 3rd and 4th touching the posterior sublinguals. *Sublinguals.*—Two pairs, the anterior rather larger. *Costals.*—Two heads-lengths from head 15, midbody 15, two heads-lengths before anus 15. Vertebrals well developed, broader than long in midbody. Keels absent. Apical pits absent. *Ventrals.*—216 to 231. *Anal.*—Entire. *Subcaudals.*—47 to 57, all entire. *Colour.*—Uniform black above, belly whitish, more or less sullied, or mottled with slatish behind, especially beneath tail. Sides of throat, chin, and lips some times tinged yellow. *Dentition.*—*Maxillary.*—Two large tubular fangs side by side in front, succeeded after a gap by 2 or 3 small subequal teeth grooved on their anterio-external aspect. *Palato-pterygoid* 11+11, small, subequal ; the posterior pterygoid gradually reducing in length ; grooved on their inner faces. *Mandibular* 17, the 3rd, 4th and 5th rather longest, grooved on their outer faces.

Naia tripudians (Merrem).

Of 15 specimens collected, three were from Sadiya, two from near Tinsukia (Rangagara), one from North Lakhimpur (Dejoo), two from near Doom Dooma (Hansara), two from near Jaipur, and the rest from Dibrugarh. All of the specimens belonged to variety *fasciata*, some being olive-brown and others blackish. Mr. C. Gore tells me however that last year he killed a specimen in his tea-house at Barahapjan with perfect spectacles on the hood (var. *typica*). Two specimens from Dibrugarh, and one from Jaipur had the scales in 19 rows at midbody. In all the rest there were 21, but whether the costals were 19 or 21 at midbody, they reduced to 15 at a point two heads-lengths before the anus, except in one instance when they came to 13, the rows in midbody being 19. One example had eaten a toad (*Bufo melanostictus*). *Dentition.*—In two skulls before me this is as follows:—*Maxillary.*—A pair of tubular fangs placed side by side anteriorly, followed after a gap by one small tooth grooved on its outer side. *Palato-pterygoid* 7 to 8+11 to 15, small, subequal, grooved on their inner side. *Mandibular* 14, the 3rd and 4th rather longest, grooved on their outer faces.

The cobra appears to be far less common in Assam than it is in most parts of India.

Naia bungarus (Schlegel).

I only secured one specimen, though the hamadryad would appear to be by no means uncommon in Assam. The one brought to me was a ♂ 11 feet 5 inches in length, the tail 2 feet 1½ inches. This was killed within 3 miles of Dibrugarh. The ventrals were 243, and the subcaudals 93 : the 1st, 3rd, 4th and 5th only of the latter being entire. The scales at a point two heads-lengths behind the head were 17, in midbody 15, and two heads-lengths before the anus 15. The reduction from 17 to 15 was brought about by the coalescence of the 4th and 5th rows above the ventrals. The vertebral row was slightly enlarged. It was olive-brown, rather darker in shade posteriorly, and had very obscure light narrow bands which became much more apparent on separating the scales. The fang was ⅜ inch long.

Though unfortunate in acquiring specimens, I was able to collect a good deal of information about this snake from various planters and others.

Mr. Gardiner of Tezpur, who has captured specimens for the Calcutta Zoological Gardens, was also successful in securing the living specimen sent last year to our Society's collection. He tells me the Assamese call this and the cobra "fatty sap."

Mr. J. H. Bandock told me that one was killed some years ago at Margherita, which measured 14 feet 6 inches. Mr. N. C. Manders' coolies killed another specimen of the same length at Talup on the 17th October last year. I wrote to him about it, and he sent me a sketch of the shields on the head which placed the identification beyond question. This was found asleep in a drain in the day-time by his coolies, and when disturbed, menaced them with expanded hood. It was, he says, black with a pale throat. His coolies, who are Indians, probably Santals, called it "nag," and "nauk samp." He says this creature called to mind another which was killed in or near the same drain about 7 years before, measuring about 10 feet. This was a truculent beast that used to stop the coolies going along the road.

As regards food, Mr. Moore told me that he well remembers one being killed in North Cachar which, when cut open, contained a large monitor lizard. Here I may remark that another specimen killed at Buxa Dooars last year, measuring 9 feet 11½ inches, was found to have swallowed a large monitor lizard 3 feet 9 inches long. Captain

Mackenzie, my informant, says one of the sepoys of his detachment was out after a khakur (*Cervulus muntjac*). When he fired the hamadryad went for him, and he fortunately shot it too.

I have for many years been trying to elicit information on the breeding of this snake. Mr. A. J. Harrison told me that at Meckla Nuddee (across the river above Dibrugarh) he has encountered 3 hamadryads in five years. One he saw in a hollow tree, on the ground sitting on eggs. As he could not remember precisely the date, he sent for two Miris who were with him at the time. They said it was in the middle of May and that the eggs were about 30 in number. Mr. Harrison shot the snake. These men said further that on their way down to the Mills that day (15th May), they had passed a similar snake coiled upon her eggs, with her head up and hood dilated as they passed. They said you may always be sure they have eggs when they sit like that ready to strike.

Mr. W. A. Jacob, I. F. S., from whom I received a small hamadryad from Jalpaiguri last year, told me that a pair of hamadryad were reported as having been "seen in copula" and killed in a tea-garden close to him at Jalpaiguri at the end of April or early May 1908. Mr. Lister too, of Pashok near Darjeeling, told me that the natives around him say that the hamadryad has young in April, and it appears a female was killed there with 23 eggs in the abdomen.

Dentition.—This in my large specimen is as follows :—*Maxillary.*—Two large tubular fangs side by side anteriorly, followed after a gap by 3 small teeth grooved on the outer sides. *Palato-pterygoid* 8 to 9 + 10 to 12, grooved on their inner faces. *Mandibular* 15, the 3rd and 4th longest; grooved on their outer faces. The poison gland measured $1\frac{3}{8}''$ × $\frac{9}{1}''$ × $\frac{8}{16}''$ high.

Callophis macclellandi (Reindardt) (var. nov. *gorei*).

I received three specimens of a new variety of this snake from Mr. Gore from Jaipur.* This I propose to call *gorei*. The general colour of the snake is similar to that of the other varieties, *viz.*, a bright berry-red.

It is peculiar in having no black rings round the body, and no black vertebral line. This latter is replaced by a series of small distant black spots. The type I sent to the British Museum and the second specimen to our Society's collection. The type was a ♀ 1 foot 10 inches long, the tail being 1½ inches. The ventrals and subcaudals were 241 + 46. The second was a ♂. The ventrals and subcaudals were 219 + 30. The third very young, with 223 ventrals, and 31 subcaudals.

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* See remarks on locality under *Trachischium monticola*.

The type was sent to me alive. It exhibited a distaste to being handled but could not be provoked to bite an object; when taken by the neck a good large drop of poison collected below the rostral through which the tongue was protruded. It flattened itself posteriorly under excitement.

AMBLYCEPHALIDÆ.

Amblycephalus monticola (Cantor).

Two specimens were collected. One captured in Dibrugarh, and the other at Jaipur. It is essentially a hill snake, so that it is remarkable to find it in the plains as far distant from the hills as Dibrugarh. The ventrals and subcaudals were 188 + 85, and 190 + ?. There is nothing special to remark upon, except that the secretion of the anal glands is custard-like in colour and consistency.

VIPERIDÆ.

Lachesis gramineus (Shaw).

The green pit-viper is not very common in the plains of Assam I got 7 specimens in all. One was from Jaipur, one from North Lakhimpur (Joyhing), and the rest from around Dibrugarh. One specimen was greenish-yellow with a mustard-yellow flank line. In the Joyhing specimen the flank line was chocolate and white as noted in specimens from the Khasi Hills.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
1907.						
April 3rd...	♀	1′-11½″	3⅜″	164	60	Contained 2 eggs (1 in each ovary), ¾″ long.
Sept. ...	♀	2′- 5½″	5″	...	...	A rat in stomach, and large mass of matted hair in cloaca.
Nov. 9th...	...	..	...	169	56	A mouse in the stomach.
May 7th...	♂	1′-10½″	...	169	66	
?	♀	...	...	175	55	

One encountered in November was found lying on a low bush in jungle. It refused to bestir itself, though probed and hustled with a stick. It finally wreathed itself round the stick, and was removed from the bush, but offered no malice.

	NAME OF SNAKE.	1907.										1908.												
		March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June 1st to 18th.	July.	August.	September 19th to 30th	October.	November 1st to 22nd	Date uncertain.	Total.
1	Typhlops braminus	..	2	7	..	1	On leave in Khasi Hills.	..	..	..	..	..	..	..	1	3	1	..	On leave in Darjeeling.	..	..	..	..	15
2	„ diardi	..	2	..	2	5		..	..	..	..	..	..	3	..	1	..	..		..	..	1	6	20
3	Python molurus	..	..	1	..	..		..	..	..	..	..	1	..	..	.	..	..		..	..	..	2	4
4	Tropidonotus piscator	1	12	14	16	10		..	9	8	10	6	8	2	5	5	1	..		..	1	2	2	112
5	„ himalayanus	1	1	3	1	1		..	..	..	..	..	..	..	..	1	1	..		..	1	..	5	15
6	„ stolatus	1	36	36	12	7		..	8	1	..	..	2	18	15	..	..	..		..	1	2	20	159
7	„ subminiatus	..	..	..	..	..		..	1	..	..	..	..	..	..	..	2	..		..	..	..	1	4
8	Trachischium monticola	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	1
9	Lycodon jara	..	..	1	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	2	3
10	„ aulicus	1	5	7	4	9		..	2	1	1	..	..	1	5	4	1	..		1	1	..	4	47
11	Dinodon septentrionalis	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	1
12	Zamenis korros	..	..	2	3	2		..	..	..	..	..	..	..	..	..	4	..		..	..	..	2	13
13	„ mucosus	1	7	10	11	9		..	2	1	..	..	..	4	2	3	5	..		1	..	2	..	58
14	Coluber prasinus	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	1
15	„ radiatus	..	2	4	9	3		..	3	..	..	..	2	2	1	1	..	..		..	1	..	13	41
16	„ porphyraceus	..	..	..	..	..		..	.	..	..	..	..	..	..	..	..	..		..	..	..	2	2
17	Dendrophis pictus	..	..	..	..	..		..	.	..	..	..	..	..	..	..	..	..		..	..	1	..	1
18	„ proarchos	..	..	7	4	..		..	2	..	..	..	1	2	1	2	..	..		..	..	..	5	24
19	„ gorei	..	..	..	..	..		..	..	..	..	.	..	..	..	..	..	..		1	..	..	1	2

	NAME OF SNAKE.	1907.										1908.												Total.
		March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June 1st to 18th	July.	August.	September 19th to 30th	October.	November 1st to 22nd.	Date uncertain.	
20	Dendrophis biloreatus	..	..	..	..	..	On leave in Khasi Hills.	..	..	..	..	..	..	..	..	..	..	..	On leave in Darjeeling.	..	..	..	1	1
21	Simotes albocinctus	..	..	..	..	1		..	..	..	.	..	..	..	..	..	..	..		..	..	..	8	9
22	„ violaceus	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	2	2
23	Oligodon dorsalis	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	1
24	Hypsirhina enhydris	..	..	..	..	..		..	..	1	..	..		..	..	.	..	..		..	..	..	..	1
25	Dipsadomorphus gokool	1	1	1	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	4
26	„ cynodon	..	..	..	..	..		..	..	..	..	..	..	..	1	..	..	..		..	..	..	..	1
27	„ quincunciatus	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	2	2
28	Psammodynastes pulverulentus	..	..	1	..	2		..	..	..	..	..	..	..	..	..	..	..		..	..	.	2	5
29	Dryophis prasinus	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	1		..	..	..	5	6
30	Bungarus fasciatus	..	1	..	4	2		..	1	2	1	..	..	..	2	2	..	..		..	1	..	6	22
31	„ lividus	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	1	1
32	„ niger	..	1	1	1	..		..	1	..	..	..	..	..	..	..	2	..		..	..	..	3	9
33	Naia tripudians	..	..	2	2	..		..	..	..	..	..	..	..	..	..	..	..		1	..	..	10	15
34	„ bungarus	..	..	..	..	..		..	..	..	..	..	..	1	..	..	..	..		..	..	..	..	1
35	Callophis macclellandi	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..		..	..	..	3	3
36	Amblycephalus monticola	..	..	.	..	..		..	..	..	..	..	1	..	..	..	..	..		..	..	..	1	2
37	Lachesis gramineus	..	1	..	..	..		1	..	1	..	..	..	..	..	1	..	..		..	..	..	3	7
	Total ..	6	71	97	69	52		1	29	15	12	6	15	33	33	23	17	1		4	6	8	117	615

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. Bell, I.F.S.

Part VII.

(*Continued from page 682 of this Volume.*)

45. **Moduza procris,** *Cramer* (fig. 9).—Male and female *upperside* rich ferruginous red. Fore and hindwings with a series of short black transverse lines at base, three on the fore, four on the hindwing ; on the hindwing these lines occur in cellular area only and are very slender with a black spot in each of the interspaces above them ; a white spot, varying in size, at apex of cell on forewings ; a broad white, macular, slightly curved, common discal band, set in a dusky background, interrupted anteriorly on forewing ; the spots in interspaces 4, 5 and 6 are detached and slightly out of line, the first very small. Forewing : terminal margin somewhat broadly dusky black, the black produced in conical shape inwardly in the interspaces and traversed by two slender, lunular, pale lines. Hindwing: a postdiscal series of transverse black spots followed by an outer row of smaller spots, a subterminal lunular black line and a narrow terminal black band ; a pale, somewhat sinuous line interposed between the subterminal and terminal markings. *Underside* with similar but more clearly defined markings ; base of fore and basal two-thirds of the hindwing pale blue ; on the hindwing the white discal band with its dusky black margins superposed on the blue area ; the postdiscal series of black spots on the hindwing diffuse ; the sinuous lines traversing the black terminal margin on both fore and hindwing broader, more prominent and the interspaces along the extreme margin touched with white. Antennæ black, ochraceous at apex ; head, thorax and abdomen dark ferruginous red ; beneath bluish white. Exp. 62-78 mm.

Larva.—The body is cylindrical, with spined processes, laterally flattened and somewhat fleshy, on segments 3 to 12. Head large, flat, surrounded with 2 rows of pointed spines, one inside the other, the spines of one row alternating with those of the other ; inside the spines, on the face, is a semicircle of 6 brownish-red rounded tubercles, inside these again are 4 more similar tubercles. Segment 2 has a central row of 8 minute spines. Each segment 3-12 has a subdorsal and a lateral pedicelled, laterally flattened bunch of spines ; the subdorsal bunch of segment 4 being the longest, directed up and somewhat outwards ; the subdorsal bunches of segments 3, 6, 11 and 12 are somewhat shorter and directed upwards ; those of segments 7 and 8 are smaller again (of equal size to each other) and are directed nearly horizontally outwards; the subdorsal bunches of segments 5 and 6 are very small ; the lateral bunch of segment 3 is equal in length to the subdorsal of segment 3; the rest of the lateral ones are all a good deal shorter and subequal; segments 13 and 14 have each a subdorsal bunch of small spines; besides the foregoing bunches there is also a spiracular line of small spines from segment 3 to 12 as well as a subspiracular pair of minute spines on the same segments. Spiracles small, oval, black. Surface of body somewhat roughened. Color of larva is a dirty grey, often inclined to chestnut-brown, always with blackish blotches; there is a thin white dorsal line on segments 2-4; the subspiracular bunch of spines of segment 6 are whitish yellow and rise from a white patch; all pedicels and spines are yellow-brown; segments 11 and 12 are light yellow laterally; abdomen lighter in colour than dorsum. L: 32 mm.; B: 4mm.

Pupa.—The pupa is angular with flattened expansions on head and on dorsal line of abdomen. It is of the *Athyma* (*vide* Pl. 1, fig. 10 a) type, but is more curved in the longitudinal axis; the head processes are bent forward and the ventral line of wings is convex as well as that of abdomen. The head and segment 2 together are nearly square seen from above, slightly broader in front, with two processes proceeding out in front, one from each eye; these processes are thick at origin, dilated each into a triangle, flattened above and below, the two touching at the inner basal angles (their apices being nearest the head) so as to leave a circular space between the touching angles and front of head, the bases of the two triangles (their free front edges) being in the same slightly curved line at right angles to longitudinal axis of pupa; these processes are longer than segments 1 and 2 together. Segment 2 is flat dorsally. Thorax is slightly keeled in the dorsal line and is evenly convex; its surface somewhat bumpy; the shoulder ridges running out, each, into a lateral short, sharp point; wings expanded somewhat from just behind shoulders, the lateral edge being sharp, curved up towards dorsum of segment 5, then evenly down to end at segment 8. The pupa is broadest at segment 7-8. The surface of each wing is somewhat concave in centre towards lateral edge of pupa. The dorsal constriction behind thorax is prominent owing to segment 6 being suddenly higher than segment 5: it overhangs segment 5 somewhat in fact, this sudden height being produced by a somewhat large lateral tubercle and a low, rough, dorsal carina or keel beginning at segment 6 and ending at segment 12, its length separated into parts by the segment-divisions, these portions on segments 10, 11, 12 being high, laterally much compressed and rectangular in outline but low on segments 8 and 9: the lateral tubercles, existing only on segments 6, 7, 8 are flat dorsally and perpendicular to the segment surface as to their lateral faces. Segments 12 and 13 are dorsally flattened and slope towards the cremaster; the cremaster is very broadly triangular, hollowed out dorsally owing to the prominent extensor ridges; the ventral extensor ridges also prominent. Spiracular expansions of segment 2 are small, round, somewhat spongy looking, golden in colour; the other spiracles are rather large, oval, brown. Surface of pupa slightly transversly creased-rugose with a few isolated, very short, bright golden hairs; a lateral coarse, low tubercle on segments 3, 4, 5. Colour of pupa is dull chestnut marked with whitish and greyish in places rather obscurely ; surface of wings very dark ; border of wings and antennæ black ; some black lines on wings ; a ventral white chain-mark down centre of abdomen. L : 24mm.; B : 11mm. at segment 7 ; at shoulders : 7·5mm.; across base of head-processes : 7mm.; L. of head-processes : 2·5mm.

Habits.—The egg is laid at the point of a leaf; the young larva, emerging, proceeds to eat the point, leaving the midrib untouched, in a straight line at right angles to that midrib, throwing up a rampart of its droppings and web along the eaten edge, thus separating the free midrib from the leaf-surface. On this rib the larva sits, generally slightly curled, and resembles the rampart so perfectly in colouration and, to a certain extent, in general aspect, that it is easily overlooked. The very young larva prolongs the midrib by adding particles of excrement to the point of it. It sticks to this method of protection until the last stage, changing the leaf of course occasionally if necessary. It generally goes to other leaves for food after the first two stages but occasionally dines off the edges of its own particular one. In the last stage it wanders about, being no longer so inconspicuously coloured and may be found in the middle of a leaf anywhere on the plant or tree when at rest. Even in this last stage, however, it looks very like a bird-dropping at times when sitting with its head bent back on its side, which is a favourite resting position. The larva may even rest on the underside of a leaf in this last stage. It wanders a little prior to pupation and finally fixes itself on to the under surface of some leaf where it spins a copious wad of silk to hang by. The pupa is fixed very rigidly to this wad and hangs quite perpendicularly though with the body generally somewhat curved and resembles much a freshly withered, red-brown, rolled leaf or leaf-portion. The pupa is occasionally attached to a perpendicular stem or branch. There are generally two or three, sometimes even as many as a dozen larvæ on a single tree. The butterfly is a strong flyer with the habits of the *Athyma* group (*Pantoporia*, *Athyma*, *Limenitis*), that is it holds its wings horizontal, sailing along for short intervals ; is fond of the sunlight and therefore frequents dry hill sides in the jungly parts of the country where the monsoon is heavy. The males are as commonly seen as the females. Its distribution is Peninsular India in regions of heavy rainfall ; Assam ; Burma and Tenasserim, extending into the Malayan

Subregion. It will be found in Thana and in all hill stations of the Bombay Presidency. The foodplant of the larva is *Mussænda frondosa* the well known scandent shrub with the small red tubular flowers and showy white calyx-segments resembling leaves in size and development; *Wendlandia exserta*, Dc., with opposite leaves, and *Wendlandia Notoniana*, Wall., with three-whorled leaves, both plants generally shrubby in nature, sometimes growing to small trees and found in somewhat dry situations; *Sarcocephalus missionis*, Haviland, a small tree with shiny long leaves and globular heads of closely growing greenish small flowers which affects the banks of rivers in North Kanara. All three genera are belonging to the family of the *Rubiaceæ*. It also feeds upon *Stephegyne parvifolia*, Korth (*Mytragyna*, Korth.) a large tree belonging to the same family known by the vernacular name of *Kalam*.

46. **Athyma perius,** *L.* (Plate C, fig. 14) and (fig. 12).—Male and female *upperside* black (perhaps blackish brown in the female), with the following white markings: forewing: a clavate, white discoidal streak, twice divided, a cone-shaped large spot beyond; a much curved discal macular band, the spots composing it in interspaces 1, 1*a*, 2 broad, rectangular, in interspace 3 small, subtriangular, in interspace 4 circular or oval, in 5 and 6 elongate, shifted obliquely inwards; a postdiscal, sinuous line of transverse narrow spots and a subterminal line of obscure, short lunules. Hindwing: discal band of forewing continued subbasally across, broad and not macular, traversed only by the veins; a postdiscal macular band, inwardly margined by a series of round black dots and a subterminal line of obscure lunules as on the forewing. *Underside* golden ochraceous yellow; the white markings as on the upperside, but heavily margined and defined with black; interspace 1*a* with subbasal and interspace 1 with preapical patches fuliginous black on forewing; postdiscal band on hindwing margined inwardly with pale blue, bearing a superposed series of black spots, the pale blue extended along the veins crossing the band; both fore and hindwing with a prominent terminal narrow black band; the cilia white alternated with brown. Antennæ black; head with a spot of golden ochraceous between the eyes; thorax with a band or two of bluish spots anteriorly and posteriorly; abdomen transversely narrowly barred bluish white; beneath: the palpi, thorax and abdomen pure white; in the female the abdomen has a double lateral row of minute black dots. Exp. 60-70mm.

Larva.—The shape is cylindrical like that of *Moduza*; there are three rows of pedicelled spines, one subdorsal, one lateral and one subspiracular; the colour is greenish, the pedicels being red. The head is round, the face only very slightly convex, with a marginal row of 8 sharp, simple, rather long somewhat shiny dark brown spines directed out at right angles to the longitudinal axis of larva; inside this row towards front is another row of 10 hard conical tubercles ; both rows reach down to the jaws ; the 2 central tubercles are the longest ; inside the row of tubercles are, towards the top of face, two hemispherical, rather large tubercles in a horizontal line and underneath these again is a row of four across the face, the outside one on each side being as large as the two in the line above, the central 2 smaller ; halfway down each side of clypeus are two more tubercles, one diagonally below the other ; the colour of the head is black, the spines being also black, the tubercles yellow. Segment 2 has a subdorsal and lateral pair of very small yellow tubercles. Each segment 3-13 has a subdorsal hard pedicel of small sharp spines, those of segments 3 and 4 being equal and longer than any other : perhaps that of the 4th is a trifle longer than that of 3rd ; those of segments 6, 8, 11 are nearly as long as these last ; those of 7 and 9 a little shorter, those of 10 still shorter and those of the 5th segment shortest of all, being $\frac{1}{3}$ the length of those of segment 4 ; those of segment 3, if laid on the body, would overreach the head slightly. Each segment 4-12 has a lateral similar spined pedicel, but much shorter, being only about $\frac{2}{3}$ the length of the subdorsal one ; and those of segment 12 are simple yellow spines. Each segment 3-13 has a subspiracular row of simple spines as well as a pedicel of spines equal in length to the lateral ones, with the exception of that of segment 13 which is somewhat smaller ; the subspiracular of segment 14 is represented by a simple small yellow spine. This anal segment has four longish dorsal, simple spines arranged, in a square, springing from a raised, hard callosity. Spiracles are of ordinary size, black, with broad brown streak, flush. Body surface is smooth and dull. Colour of body is dark yellowish green, the subdorsal and lateral pedicels rising from purple circular marks, these marks meeting across the back on segment 9; there are a lot of black dots in front and behind the mark on segment 9 ; there are also a few black dots in front of bases of subspiracular pedicels ; all pedicels are blood-red, the spines of the subdorsal ones are black, those of the others are yellow. The subdorsal pedicels, except those of segment 5, have black-tipped spinules below the top bunch. The subdorsal pedicels of segments 4, 7, 9 are further apart than those of others. Base of abdomen and legs dark red-brown ; belly greenish. L : 37 mm ; B : 5 mm ; L. of longest pedicels with spines : 3 mm.

Pupa.—The shape is that of *Moduza procris* except that the dorsal process on segment 6 is broader and longer, the thorax-apex more produced backwards and the head-processes ear-shaped instead of triangular. Here the dorsal ridge or carina is flattened into square-topped expansions on segments 6-11 ; that on segment 6 is the largest by a long way and the pupa is, therefore, highest at that point : it is sharp-edged and axe-shaped, the projection directed forwards, the expansions of segments 7 and 8 really forming, in a way, part of it, being quite small ; and situated on its hinder edge or slope ; those on segments 9, 10, 11 are quite separated from each other, somewhat toothlike, the first smallest, the last largest. The thorax has the apex produced into a sharp-edged, rounded peak, slightly overhanging segment 4, this peak being nearly as high as the expansion on segment 6, the top of which it approaches, that is, the tops of the two are nearer each other than the bases; the thorax is carinated and the dorsal slope of pupa from its apex forward is gradual, falling suddenly at head-vertex ; segment 2 flattened on dorsum ; head produced over each eye into a sharp triangular ear-like process which curves outwards ; at each shoulder, on the dorsoventral margin of pupa, is a two-toothed short process situated in the plane joining the spiracular lines of pupa, separated from the point where wing-expansion commences by a rounded sinus ; that point also slightly produced and flattened. The spiracles are ordinary. Surface smooth, shiny ; a semicircle of four small conical tubercles anteriorly ; a small tubercle on segment 5 ; segments 6, 7, 8 somewhat carinated in dorsal line and with a small lateral tubercle ; segments 9-12 with a minute subdorsal tubercle. Colour red-brown, suffused with gold on the wing-cases and dorsum, L: 25mm : B : 10mm.

Habits.—The habits of the larva in all stages are the same as for *Moduza procris.* The larva turns yellow, with greenish blue blotches, before pupating. The pupa is formed on the underside of a leaf, very generally low down near the ground. The butterflies generally fly near the ground in the underwood and these, when caught, are mostly females. They are probably bent on laying eggs. They have the same flight as *Moduza*, but are more deliberate in their movements ; and they are not quite so fond of the sun. Like *Moduza*, the insect rests with outspread wings, generally at the tip of a leaf. Neither of the two species light on the ground, though they may do so occasionally on a hot day to get moisture. It is not very common anywhere to catch or see, but the larvæ can be found in large numbers in some localities. These, however, are very liable to be parasitised by ichneumons when small. The butterfly, when resting at night, closes the wings over the back as do all of its type. The distribution is "throughout the Himalayas ; the hills of Central, Eastern and Western India, but not, as far as is known, in Ceylon ; Burma : Tenasserim, extending to Siam and the Malay Peninsula." The food plants are belonging to the botanical family *Euphorbiaceæ* which includes many plants with milky juice. This insect confines itself to the single genus *Glochidion* and has been bred on *G. velutinum*, Wight and *G. lanceolarium*, Dalz., both undershrubs or small trees, the former with velvety long oval leaves, growing in the drier localities at lower levels, the latter affecting the damper, higher parts of the country, with longer, shiny, rather hard leaves, both with inconspicuous greenish flowers in the axils of the leaves and round flattened fruits dividing up into 3 or 4 parts from the centre, Both these species are distributed throughout India in the hills.

47. **Rahinda hordonia**, *Stoll* (Plate C., fig. 13 and fig. 11).—Male and female *upperside* black with orange markings. Forewing: discoidal streak broad, anteriorly twice indented, at apex extending into base of interspace 3; posterior discal spots coalescent, forming an irregular oblique, short, broad band; anterior spots also coalescent, oblique from costa; a postdiscal, obscure, grey, bicurved, transverse line and a very slender, also obscure, transverse subterminal line. Hindwing: a subbasal transverse broad band and a much narrower postdiscal band curved inwards at the ends; beyond this the black terminal margin is traversed by a still blacker subterminal line. *Underside* chestnut-brown, covered with short, slender transverse brown striæ on the margin of the orange markings which are similar to those on the upperside but broader, paler and less clearly defined. Forewing: the pale transverse postdiscal and orange subterminal lines of the upperside replaced by a postdiscal lilacine narrow band, defined by somewhat crenulate chestnut-brown lines on either side and a pale subterminal line. Hindwing: the base suffused with lilacine; the subbasal and postdiscal bands bordered outwardly by narrow lilacine bands, the orange-yellow of the postdiscal band much obscured by the transverse brown striæ; the terminal margin with a sinuous, obscure, broad, lilacine line. Antennæ, head, thorax and abdomen black; beneath, the palpi and thorax greyish, abdomen ochraceous In the *dry-season form* the markings are similar, but very much broader; on the *upperside* of the forewing the postdiscal line generally and the subterminal line always clearly defined, the former, sometimes, like the latter, orange-yellow. *Underside* paler, blurred, the transverse short brown striæ in many specimens covering nearly the whole surface of the wings. Exp. 38-54mm.

The orange of the coloured figure is not bright enough, the black not deep enough.

Egg.—It is shaped like a sea-urchin but is higher than broad; the surface is covered with rows of hexagonal cells with their bottoms concave and shiny, each angle of each cell bearing an erect, minute, colourless spine; there is a small round depression on the top round which there are 7 of the hexagonal cells. and there are 7 rows between it and the base of the egg. Colour azure-blue. B: about 0. 8mm.

Larva.—The body is more or less cylindrical but somewhat thickest at middle; there are small fleshy, short, conical tubercles dorso-laterally on segments 3, 4, 6 and 12; the colour is grey-green with dark green diagonal markings. The head is triangular, the apex rounded; the clypeus small, triangular; dull olive-green in colour with a whitish cheek-stripe; the surface covered with little white tubercles bearing each a very short hair. The body surface is dull and covered all over, as well as the belly, with tiny white tubercles bearing each a short hair; the anal segments have a few short, erect, reddish hairs. Anal flap with tumid extremity, triangular in shape. The first pair of dorso-lateral tubercles, on segment 3, are very small; the next, on segment 4, as also the pair on segment 6, are longer and equal to each other: the pair on segment 12 are as long as these last but thinner · all tubercles are set with short erect hairs at their ends. Spiracles are nearly circular, small, shiny dark brown in colour. The markings are as follows: there is a slightly raised subspiracular fold of skin from segment 5 to segment 12, approaching nearest to the base of legs on segments 7 and 8, being slightly curved: there is a white dorsal line, flanked by dark-green narrowly, from end to end of larva; the space included between the tubercles of segments 4 and 12, bounded laterally by a line connecting the bases of the former tubercles with the end of the fold on segment 5, then by the fold as far as front margin of segment 9, then by a line connecting this point with the dorsal line at posterior margin of segment 11 is green strongly suffused with grey; all the body anterior to this space (which may be called the saddle) and segment 8 (on the saddle) is light olive-green getting whitish upwards; the part of body after segment 8 below the saddle as far as anal claspers is dark olive-green; there is a black diagonal band along the line separating this dark olive part from the grey-green saddle; each segment 6, 7, 8, 9 is marked laterally with a dark green diagonal stripe of which that on segment 6 is often the best defined, the succeeding ones becoming more and more indistinct. L: 25mm.; B: 4mm.

Pupa.—The pupa is of the same shape as that of *Neptis jumbah*, though smaller. The thorax is somewhat highly keeled in dorsal line, as also the abdomen in the posterior part; the wings are expanded laterally, the margin (lateral margin of the pupa) being sharp and slightly waved: the outer margin of wings is also slightly waved. The front of the head is widely and shallowly concave, sharp edged dorso-ventrally, the vertex is slightly convex, the ascent in dorsal line is slight. The dorsal slope of thorax is at 45° to the longitudinal axis of pupa, the apex the same height as abdomen at segment 6, the wing-expansion curve nearly rising to the same height as the apex of thorax. Cremaster flat and triangular with extensor ridges developed dorsally. Spiracles ordinary in size, roundly oval, raised, dark brown. Surface of body extremely finely rugose with transverse striæ; segment 5 with a flat, raised, rather large subdorsal surface which is shiny mother-of-pearl; segment 4 with two such surfaces on each side, one subdorsal, the larger, the other, lateral, much smaller; the thorax has two such raised surfaces in juxtaposition slightly anteriorly on lateral margin, the anterior one the smaller and another just in front of these: segment 2 has one such lateral spot; the colour of the pupa is green, wings darker, indications of diagonal bands on abdomen. L: 12: mm.; B: 4·5mm., at widest part of wing expansion; H: 4·2mm.

Habits.—The egg is laid on the top surface of a leaflet. The young larva, emerging, cuts the midrib of the leaf nearly through, then cuts the leaflets off at their bases, attaching them by silken threads to their respective places, and cuts the pinnæ through in several places, fastening in the same way with silks to prevent them becoming detached and falling to the ground: so that the part of the leaf beyond where the midrib is nearly cut through hangs down laxly and withers. The egg larva cuts through the stalks of a few leaflets at the point of one of the pinnæ as often as not and, as it grows, continues the work. The full grown larva changes its leaf perhaps once or even twice occasionally, treating it each time as above described. It lies on the last pinna, hidden by the leaflets and other pinnæ. It pupates there also. The larva eats the withered leaves as long as they are not too dry. It resembles them in colour very much and there is no doubt that the ruse acts as a protection against predaceous spiders and birds to a certain extent. The pupæ however are much parasitised by ichneumon wasps of small size: the ichneumon laying its eggs in the larva. It would therefore be more correct to say that the latter is parasitised and not the pupa. The butterfly never rises much above the surface of the ground and is a weak flier, generally resting on the leaves of bushes in fairly thick places: and also generally somewhere in the neighbourhood of the foodplant of its larva. The wings are held fully open or slightly inclined to the horizontal when basking in the sun but they are closed over the back in dull weather or when the insect seeks protection. The flight is something after the manner of an *Athyma*, the wings being hardly ever brought to touch over the back though they are raised higher than in that genus between the downward strokes. The insect is very fairly common in places though perhaps not as plentiful as *Neptis eurynome* and it is also perhaps slightly scarcer in open country than that species. There is another larva very much like this one which, however, has the tubercles much more developed, in fact they are large enough to be called spinous processes: the head also has each lobe produced into a small point; the description is as follows:—

Larva.—Is like that of *hordonia* in shape and markings and, to a certain extent, also in habits. The head is trapeze-shaped, the narrower end being the vertex, and is divided down the middle by a depressed line; the vertex of each lobe is produced into a short blunt point, the two points not widely separated. The four pairs of fleshy tubercles on segments 3, 4, 6 and 1 are thrice as long as in *R. hordonia* and are directed slightly backwards, the tubercles of each segment are not connected by a ridge as in that species. The spiracles and surface of larva are the same. The colour is: a white dorsal line; the "saddle" on dorsum of segments 4-10 is brown-green or red-brown of varying shades in different specimens with similar diagonal lines on segments 3-7 as in *R. hordonia* ; the head and rest of the body are brown apple-green with the subspiracular ridge light, white on segments 11 and 12 ; the first pair of processes or projections are black on the outside margins ; there are white lateral points or lines on segments 2-5 ; a black line from base of each proleg runs up the anterior part of it to the subspiracular ridge which is present also on segments 5 and 6 ; belly lightish green with a fine central dark line ; the colour may vary from light grey-green to dark brown-red green. The length and breadth as for *R. hordonia.*

Pupa.—The pupa is not distinguishable from that of *R. hordonia* except that the wing expansion is perhaps slightly more curved up, the sinus in front of head perhaps slightly shallower. Length and breadth and colour as in that species.

Habits.—Are like those of *hordonia* but differ in that the larva lives an opener life. not cutting leaflets in the same profusion as that species. It pupates in a similar manner. Both walk in a halting manner.

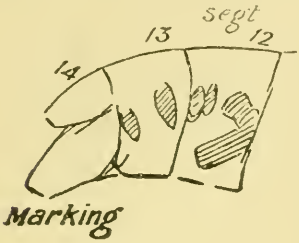
Which of these two larvæ produces true *R. hordonia* is still a moot point. We have called the first by the name for the time being. It is indeed rather difficult to find any difference between the insects produced by the two the more so since both butterflies are somewhat variable according to season in colour and heaviness of black markings. The males have a sex-mark on the upperside of hindwing, about the middle of the costal area, which appears to be darker in the second form than in the first. Further breeding will perhaps set the question at rest but at present it is impossible to say with certainty whether we have to do with different species or whether the larva is dimorphic. There seems to be little reason for this latter supposition for the larvæ are found in the same place at the same seasons. The foodplants however differ for, while the first form is found only on *Acacia pennata*, Willd., with numerous small leaflets, the former affects *Albizzia oderatissima* Benth. and *Acacia concinna*, Dc. also, the latter a similar creeper to the first but growing in damper localities and having less numerous, larger leaflets. *Rahinda hordonia* is spread over Continental India from the Himalayas to Travancore ; Assam ; Burma ; Tenasserim, extending into the Malayan subregion.

Note.—For the uninitiated : the leaves of these *Acacia* creepers (all extremely prickly or thorny) are said to be *bipinnate*, that is the midrib bears a series of opposite branchlets or *pinnæ* which bear in their turn the leaflets, also opposite to each other and close together while the pinnæ are widely separated.

48. **Neptis eurynome**, *Westwood* (fig. 13, underside and Pl. C. Fig. 12, male).—Male and female *upperside* in the dry season are black, with pure white markings. Forewing: discoidal streak clavate, apically truncate, subapically either notched or sometimes indistinctly divided; triangular spot beyond broad, well-defined acute at the apex, but not elongate; discal series of spots separate, not connate, each about twice as long as broad; postdiscal transverse series of small spots incomplete, but some are always present. Hindwing: subbasal band of even or nearly even width; discal and subterminal pale lines obscure; postdiscal series of spots well separated, quadrate or subquadrate, very seldom narrow. *Underside* from pale golden ochraceous to dark ochraceous, almost chocolate; white markings as on upperside but broader and defined with black. Forewing: interspaces 1a and 1 from base to near apex shaded with black, some transverse white markings on either side of the transverse postdiscal series of small spots. Hindwing: a streak of white on costal margin at base, a more slender white streak below it; the discal and subterminal pale lines of the upperside replaced by narrow white lines with still narrower margins of black. Antennæ, head, thorax and abdomen black; the palpi, thorax and abdomen beneath dusky white. Exp. 44 70mm.

The *wet season form* differs only in the narrowness of the white markings and in the slightly darker ground colour and broader black margins to the spots and bands on the underside.

Larva.—The larva is not unlike that of *Rahinda* in shape, but is different in aspect, being much rougher owing to more developed and somewhat densely set tubercles all over the surface; the place of the points on segments 3, 4, 6, 12 is taken by bent fleshy processes, also set with tubercles, each bearing a short hair, as do those of the body; these tubercles somewhat flattened and generally curved out and downwards; being fleshy, they are to some extent erectile; the pair on segment 4 being more than twice the length of the others, those on segment 6 the smallest; those of segment 4 are connected by a distinct straight ridge, those of segments 3 and 6 also, but to a lesser degree; the head is perhaps a little higher than in the second form of *Rahinda hordonia* and the vertex points are somewhat more developed and sharp instead of blunt, and further apart, divided by a rounded sinus, the surface a good deal rougher tuberculate; clypeus small as in the other; the surface covered with tubercles, of which one on each side of clypeus-apex and two on middle of face of upper part of each lobe much larger than the rest; all tubercles of head and body yellowish; the colour is similar, varying a good deal in shade, generally brown with the saddle suffused with grey, a suffusion of ochreous mottled with brown and with the stripe on the place where the leg is or would be on segments 5, 6, 7. The spiracles are similar, the anal flap tumid, as in that species; the subspiracular ledge is strongly developed on segments 6, 7, 8, and the tubercles on it longer and thorn-like, though thin; the dorsal white line is present, though



thin ; the dark (green, brown or chocolate), lateral region on segments 11, 12, embracing the whole of segments 13, 14 is also here ; the diagonal stripes alone are indistinct above the ridge on segments 4-10 ; there are some greeny white or cream-coloured lines on the ridge below spiracle of segment 11 and very often, some spots or a line of the same colour above it ; but these may be entirely wanting ; the belly is the colour of the dark lateral portion of segments 11-14 with a darker central line except on the front two segments where the colour may be lighter in colour and more approaching that of the "saddle". The length of the processes of segment 4 is 2mm., and all processes are somewhat pronouncedly spiny or tuberculous at extremities. Owing to the long processes the larva looks thickest at segment 4, especially when at rest with its true legs bunched and the front of body from segment 7 forwards raised and bent sharply at segment 5 6, the face turned down, which is the usual position. L : 21mm.; B : 4mm. at middle.

Pupa.—This pupa is of the type of that of *Rahinda hordonia* but is larger, broader comparatively, generally stouter, the wings more expanded laterally, their dorsal margins more pronouncedly waved and the rounded tornal angle produced upwards so as to be higher than the general surface of the pupa at segment 6, the terminal margin therefore, longer here than in that species ; the pupa is broadest at segment 6 ; the head-vertex is perpendicular to longitudinal axis of pupa and separated from the ventral surface by a distinct ridge which is continued to the point of a short, stout, triangularly pyramidal projection pointing out forwards and laterally from each eye : the lateral outline of the pupa being formed by one side of the pyramid, another side making a ridge to the base of antenna ; the head with segment 2 make an oblong solid, the upper surface being the flat second segment, the two prominent eye-projections forming the lower anterior corners, the anterior face, the head-vertex, the under surface being the face of head which is here ventral; the base of each antenna is slightly prominent forming a small tubercular projection pointing forwards; the lateral outline of the pupa diverges from the central axis slightly from the hinder margin of segment 2 to the shoulder, where there is also a small prominent tubercle pointing outwards, the wing expansion commencing immediately afterwards ; the dorsal line of pupa ascends from segment 2 (which is parallel to longitudinal axis) at first at right angles to that axis for a short space, then for about two-thirds the length at an angle of 45° in a slight curve to the apex—the whole slightly carinated, most highly at apex—whence it falls rather suddenly and shortly to segment 4 and so to segment 5, whence it rises again somewhat gently to near hinder margin of segment 6—without carination—then curving down in a quarter circle curve to cremaster—here, again, carinated slightly, the carination being higher at the hinder margin of each segment than at the front margin of the succeeding one ; in the ventral line the head is convex, the wing-junction line is straight and the abdomen is curved after the thickened end of wings ; the thorax is humped, that is, convexly prominent, the hinder margin a quarter circle curve meeting the wing-line in a broad, open rounded angle of about 90°. Spiracles of segment 2 indicated by a small oval orange flat surface facing forwards formed by the front margin of segment 3, being raised in a short curve above margin of segment 2 ; the rest of the spiracles oval, hollow, dark brown, rather small. Surface of pupa somewhat shiny, smooth, with a central dorso-lateral rather prominent, conical small tubercle on segment 6 and an indication of a blunt one on segment 4. The cremaster as in *Neptis jumbah*. The colour of the pupa is a pearly greenish yellowish-white, the thoracic margin, wing-expansions, antennæ, the venation of wings, head-points, shoulders and dorsal line marked with olive brown ; there is also a brown spot at centre on each side of proboscis inside and a larger one opposite it on the other side joined by a brown line to the origin of veins 3 and 4 on the wing, a fine brown transverse discal line and a similar subterminal line to wing the terminal margin narrowly brown ; a golden suffusion on abdomen above and below, especially on dorsum of segment 4, resembling mother-of-pearl. L : 9mm. ; B : 6·5mm. across wing-expansion at segment 6 ; 3mm. across head.

Habits—The egg is always laid on the upperside of a leaf and generally at the point. The little larva on emerging, immediately, after eating the egg-shell, proceeds to make a bed for itself upon the extreme point of the midrib, gradually eating pieces of the leaf and leaving it free ; it does not actually eat all the pieces but gnaws a lot free and hangs them by silken threads from its perch. It does not, like *Rahinda hordonia* gnaw partially through the midrib and live amongst the little pendent pieces, but sits quite openly on its bed It eats withered pieces of the leaf with apparent gusto like *Rahinda*. As the larva grows it lengthens the free portion of the midrib by eating off more and more surface of the leaf. After the third moult, however, it will generally gnaw the stem of a leaf or leaflet through partially, so that it hangs down and withers, curling in the process : in this it sits, wandering away to feed. The colour of different larvæ varies to match the different shades of withered leaves. The larva is sluggish, walking haltingly and resting very generally with the head turned round on the side and with the face bowed. The pupation takes place on the underside of a leaf or twig, as often as not from a perpendicular branchlet or stalk and the attachment is strong and firm, so that the pupa hangs rigidly : it wriggles when touched. The butterfly has much the same habits as *Rahinda hordonia* and frequents much the same places, although, perhaps, it is the commoner of the two. It flies also in the same manner, though somewhat stronger on the wing and rests in the sun with the whole of the upperside visible; it closes the wings over the back when it wishes to hide or during rain, or when it retires for the night. The insect is found throughout the whole of Continental India and Ceylon; in Assam, Burma and Tenasserim, and extends to China and the Malayan subregion. Its foodplants are various species of *Leguminosæ*, *Tiliaceæ*, *Malvaceæ*, botanical families containing Vetches, our English Lime-tree or Linden, and the Mallows respectively. Generally the larva has been found on *Cylista*, *Flemingia*, *Mucuna*, *Xylia* of the first family; *Grewia*, *Triumfetta* and *Corchorus* of the second and *Bombax* of the third. The family *Sterculiaceæ* gives another genus, namely *Helicteres* and the *Oleaceæ* still another *Mappia fœtida.* So there is no lack of foodplants, and no reason why the insects should be limited in its area of distribution.

40. **Neptis columella**, *Cramer.*—Male and female *upperside* black with white markings. Forewing: discoidal streak, widening towards apex; notched preapically on the anterior margin and obliquely truncate at apex spot beyond large, broadly triangular, well separated; discal spots in pairs, varying in size, spot of this series in interspace 1*a* always elongate; spots in transverse postdiscal series obscure, not all well defined, margined on both sides with deeper black than that of the ground-colour; the space between the series and the discal spots and also the terminal margin beyond it with obscure transverse pale markings. Hindwing: costal margin broadly greyish-brown; subbasal band not extending to costa, of varying width; discal and subterminal pale transverse lines, the space between them darker than the ground-colour, traversed by a prominent postdiscal series of spots of varying size. Cilia white alternating with black. *Underside* ferruginous brown; white markings as on the upperside but broader: the pale marking between the discal and postdiscal series of spots, the subterminal markings on the upperside of the forewing and the discal and subterminal pale lines on the upperside of the hindwing represented by pale lunular transverse whitish markings. The costal margin of the hindwing above vein 8 very broad, especially in the female. Antennæ dark brown to black; head, thorax and abdomen dark brownish black; beneath white. The *dry season form* has the white markings generally broader and the ground-colour of the underside brighter. Exp. 66-75 mm.

This *Neptis* has not been bred, though it was once, it is thought, seen laying eggs on a creeper of the genus *Dalbergia.*

Habits.—There is nothing to distinguish the imago from *Neptis jumbah* in the general habits though it is much more of a jungle insect than that species. It exists in Western and Southern India and is recorded from

Mahableshwar, Kanara and the Nilgiris; also from Sikhim, Bhutan, through the hills of Assam, Burmah and Tenasserim to the Malay Peninsula, Siam and Sumatra. It will not be found in the true Plains.

50 **Neptis jumbah**, *Moore.*—Male and female similar to *N. columella*, but with the following differences :—*Upperside* fuliginous black, the interspaces between the veins deeper black, very conspicuous in certain lights, particularly so between the subbasal and postdiscal markings on the hindwing; the white markings suffused with very pale bluish green; the posterior two spots of the discal series of the forewing subequal; the postdiscal macular band on the hindwing with a tendency to obsolescence, varying from a narrow series of white lunules to a somewhat diffuse, transverse, narrow pale band. On the *underside* the ground-colour is paler than in *N. columella*, the interspaces between the veins conspicuously much darker; the postdiscal and subterminal markings on both fore and hindwings diffuse and very ill defined. In the female the spots on the forewing and the subbasal band on the hindwing are comparatively broader than they are in the male; in the *dry season form* of both sexes, as compared with the *wet-season form* often conspicuously broader. Antennæ, head, thorax and abdomen as in *N. columella*. Exp. 62-70mm.

Egg.—The form is dome-shaped, broadest just above the base; there is a six-sided depression in centre of top surrounded by seven similar six-sided depressions and there are six rows of such depressions from top to base not counting the central top one; the walls of these pits are thin and there is a thin, short, fine spine at each intersection: otherwise at each angle of depression; the bottoms of the pits are concave, shiny and smooth. The colour of the egg is green. The breadth is 1·1mm., equal to the height.

Larva.—The body is the same shape as that of *Neptis eurynome*, exactly in every particular, that is, thickest in the middle, though appearing to be thickest about segment 4, where the longest pair of excrescences are. Head is trapeze-shaped seen from in front, the vertex being the shortest side, the lateral lines the longest; the basal line across jaws is slightly curved; the vertex is triangularly indented, each lobe having a short pointed tubercle on the vertex; the surface is set with small, shortly-setiferous tubercles: the colour is red-brown, a dark-brown check-stripe, with a similar line down centre of face splitting down the sides of clypeus. Segment 2 is a good deal narrower than head, and lower. Segment 3 is larger in diameter than segment 2, similar, but with a well-defined dorsal central ridge, ending in a small dorso-lateral, brushy, fleshy tubercle or process, running across it at right angles to the body-axis, the ridge being as long as the larva is broad at that point. Segment 4 has a similar ridge which, however, is a great deal more developed and ends at each side in a long, fleshy, anteriorly and posteriorly compressed process which is shortly haired at tip: these processes curve at first out and then towards each other like a pair of horns, and are as long as the breadth of the body at the point where they are situated. Segment 5 has no processes or ridge. Segment 6 has a ridge parallel to those of segments

3 and 4 dorsally, but no processes except the abrupt ends of the ridge may be called such. Segments 8-12 decrease gradually in diameter and the last has a short, fleshy, subdorsal (or dorso-lateral) tubercle or process which curves backwards, the two connected by a low ridge and set with short hairs. There is a slight ridge subspiracularly on segments 5-8. Segments 13 and 14 slope quickly in the dorsal line to the narrowly rounded anal flap. Segments 10-12 never rest on the surface the larva is on. Body surface covered with very small, shortly setiferous yellow tubercles. Spiracles oval, black. The colour is rosy brown suffused with smoky dorsally on segments 4-8; ridge dark on the front face, yellow on top; below a line from the lower anterior marginal corner of segment 8 to the base of the tubercles of segment 12, the colour is deep velvety black-red which colour is that of the whole of segments 13 and 14; a smudge of same colour on lateral face of ridge of segment 6; indistinct diagonal darkish bands laterally meeting on dorsum of segment 7 and segment 8, running from base of prolegs of preceding segments backwards; on the black red portions of segments 10-12 there may be some bright large emerald-green marks which are not often absent; there is a lightish dorsal line; belly a little lighter than segments 13 and 14. L: 23 mm.; B: 4·5 mm. at segment 4.

Pupa.– The pupa is very similar in shape to that of *Rahinda* (but broader) and of *Neptis eurynome.* Head and segment 2, nearly square seen from above, broader than long, produced at the two front corners into a ventrally flattened triangularly pyramidal short, broad, stout point, directed out and forwards; the front of head is slightly concavely curved and rather deep dorsoventrally: the dorsum of segment 2 is flat; the wings are expanded gradually from the shoulders to segment 6, the lateral line somewhat concave in centre and ascending gradually until it is higher than dorsum of pupa at that segment; thorax large, carinated in dorsal line, ascending in that line from segment 2 to the prominent though rounded apex, then descending rapidly to hinder margin; a slight dorsal constriction behind thorax; wing surfaces inclined to each other at an angle of 70°; pupa highest at thorax-apex, broadest at segment 6; the dorsal line descends from thorax-apex to segment 6 front margin, then rises suddenly, to descend again gradually in a curve of a quarter-circle to cremaster: the abdomen is lowly keeled in the dorsal line, this keel being higher at the hinder margin of each segment than at the front margin of the succeeding one. Cremaster with strong dorsal and ventral extensor ridges, triangular, at right angles to axis of pupa. Surface smooth, a small boss at spiracle of segment 2 and a subdorsal conical, sharp tubercle on segment 6. Spiracles oval, black, small prominent. Colour dark red-brown to yellow-white, generally strongly suffused with gold with a subdorsal gold patch or spot on segments 2, 3, 4, 5. L: 16mm.: B: 8mm.; at segment 6, at head front: 4 mm.; H. at apex of thorax: 6mm.

Habits.—The egg is laid at the point of a leaf or leaflet. The larva, emerging, eats the midrib free, attaching bits of leaf by silks to the rib which hang down loose, leaving the point of rib with a little wing of leaf-surface on each side upon which it sits; when full-grown cuts off entire leaflets or leaves attaching them to stalk by silks and lives on one of these hanging leaflets or leaves. The pupa is formed hanging from the underside of a leaf or sometimes from the end of the original midrib. The ways of the butterfly are very similar to those of *Neptis eurynome* or *Neptis columella*, but more like the latter in its habit of flying higher up than the former and in its liking for jungly places; it rests in a similar manner. The insect exists in Bengal, Southern India, in Kanara and Travancore, the Nilgiris, Ceylon, Burma, Tenasserim and the Andamans. The foodplants are many, even more numerous than those of *Neptis eurynome*. It has been found on many *Leguminosæ*, mostly trees such as *Xylia dolabriformis*, *Pongamia glabra*, shrubs and creepers such as *Dalbergiæ* and *Wagatea spicata*; on *Malvaceæ*, such as *Bombax malabaricum*, *Thespesia populnea*, *Hibiscus*, &c.; *Tiliaceæ* such as *Grewia*, *Elæocarpus*, *Rhamnaceæ* such as *Zizyphus*, &c.

51. **Cyrestis thyodamas,** *Boisduval* (Plate C., fig. 11).—Male and female *upperside* white, in many specimens, pale ochraceous yellow, veins black. Forewing with four very slender, irregularly sinuous transverse black lines, the costal margin shaded with ochraceous at base and fuscous beyond; cell crossed by three or four additional fine short lines; a postdiscal very incomplete series of white-centred broad fuscous rings in the interspaces, tinged with ochraceous near the tornus and broadly interrupted in interspaces 3 and 4; beyond this two transverse black lines not reaching the dorsal margin, shaded with fuscous between; a pronounced subterminal black line; terminal margin black, the area between lilacine-grey; cilia grey; the apex broadly shaded with fuscous. Hindwing with three transverse fine lines; a pair of postdiscal, broad, black lines shaded with light sepia-brown between, forming a conspicuous band, the outer line broken and incomplete, followed by two irregular fine black lines, a subterminal more pronounced black line and, posteriorly, a narrow black terminal margin; dorsal margin broadly fuscous at base; apical half and the tornal area and lobe rich ochraceous with some sepia-brown and black markings. *Underside* similar, the markings of the upperside showing through by transparency; the ochraceous shading on tornal area and dorsum of hindwing of less extent but the tornal lobe darker ochraceous with a central round black spot. The markings both on under and upperside vary little in depth of colour and breadth. In many specimens there is a diffuse fuscous spot between the discal pair of transverse fine lines on forewing. Antennæ, head, thorax and abdomen with dorsal and lateral black lines; white below. Exp. 48-70 mm.

Egg.—Is highly dome-shaped, almost conical, ridged longitudinally, with an aperture at the top fitted with a deeply dentate flat cap like a cogged wheel, the cogs fitting into corresponding openings round the top of the body of the egg, the resulting teeth between the openings being the tops of the longitudinal ridges. The colour is a greasy-shiny yellow. The length would be slightly over 1 mm

Larva (Pl. 1., fig 7).—The form of the larva is spindle-shape, with a pair of outward curved long horns on the head, a long, recurved, dorsal horn on segment 6 and another, curved forwards, on segment 12 ; the colour is dark brown with a broad spiracular yellow band on segments 7 14. The head has the face flat, the surface tubercular-rugose, each lobe having a long, outwardly curved horn, in the same plane as the face, on its vertex ; these horns first diverge slightly and strongly and are separated at base by a small semicircular sinus ; they are twice as long as the head is high, their surface as well as that of the rest of head set with small black setiferous tubercles ; colour of head and horns brown-black, a line down centre of face as well as the back and inside face of horns light brown ; a greenish-white cheek-stripe. Segment 2 narrower than head ; so is segment 3 ; rest of body is thicker than the head is broad, very slightly broadest in the middle ; anal end somewhat narrowed, the anal segment sloping dorsally considerably, square at extremity ; segment 6 has a very stout, recurved, dorsal horn pointing backwards, longer than the body is high and covered thickly with small conical setiferous tubercles, those on the posterior face being longer and spine-like ; segment 12 has a similar horn, directed slightly backwards but curved forwards, the tip slightly recurved tubercled throughout its length, the posterior tubercles longer ; both these horns (on segments 6 and 12) are dark brown in colour with a yellow annulus before the point. Spiracles roundly oval, large, nearly flush, light brown in colour. Surface of body covered with small, shortly setiferous tubercles, the tubercles black on the body and yellow on the yellow spiracular band Colour of the body dark brown with a broad yellow-green spiracular band from the front margin of segment 7 to the end of larva, commencing broad and thinning posteriorly ; belly watery reddish brown. L : 33 without horns, 36 mm. with ; B : 4mm ; L. of head-horns : 4·5mm ; of horn on segment 6 : 5mm; of that on segment 12 : 5mm.

Pupa (Pl. I, fig. 7 a.)—The pupa is a mixture between those of *Apatura camiba* and *Moduza procris* in shape but has two long head-processes starting out straight in front in the same plane as ventrum, curving up strongly towards dorsal plane, slightly separated from each other at origin and at extremity but closely applied to each other throughout most of their length; they are conical at base, cylindrical afterwards and are set with minute tubercles, especially near the tips. The thorax is highest near its hinder margin, slightly keeled in the dorsal line, this line descending at 45° to longitudinal axis of pupa towards segment 4 to rise slowly from anterior margin of segmetn 6, then rapidly from hinder margin of that segment, nearly perpendicularly to its former course, to the anterior top angle of a trapeze-shaped, laterally flattened expansion of the dorsal keel over segments 7 and 8, of which the posterior edge, parallel to the anterior, is longer than the same and curves into the dorsal abdominal carina behind, this carina soon merging into the dorsal surface: thus making the abdomen appear somewhat laterally compressed; the abdomen is slightly curved, decreasing gradually in diameter from segment 8 to end; the cremaster and segment 14 are flattened dorsally and ventrally and curved with a depressed elliptically shaped surface dorsally, at the extremity of which are fixed the little hooklets for suspension; the ventral line is straight from head to segment 12; wing surfaces meet at a very obtuse angle and their dorsal edges are expanded very slightly from shoulders to segment 7, commencing gradually; the body is thickest at middle of thorax. Body surface more or less smooth, slightly shiny. Spiracles not small, oval, ordinary. Colour of body is an olivaceous brown grey, finely veined darker; sometimes red-brown. L: 22mm. over all; of head-process: 4mm.; B: 5mm.

Habits.—The little egg-larva opens the cap and emerges; does not eat the egg-shell and lives on the underside of the leaf in much the same manner as the larvæ of *Athyma* or *Moduza*, *i. e.*, it eats the leaf along the midrib at the tip generally, but sometimes along a side-rib from the edge inwards. The egg is, by the way, nearly always deposited on the underside of a young leaf. The larva does not always lie on the free rib thus left, though it sometimes does so; it eats voraciously, and therefore grows rapidly. The pupa is formed under a leaf or suspended from a stalk or twig, hangs perpendicularly down and is strongly attached. The trees chosen for laying are large trees in young leaf as a very general rule, and the larva eats young leaves only. The places chosen are fairly damp, airy localities in the jungles, generally in more or less open spots, that is, where the jungle is not too thick, in fact, in such spots as are favourable to the growth of the foodplants. The perfect insect flies mostly with its wings horizontally stretched keeping them in this position for a longer time between strokes than any other butterfly we know; it is a somewhat frail insect, rather weak of flight, though quick enough on the wing to escape or avoid capture with a certain ease, and invariably rests with its wings widespread. It flies very high at times and may be seen round the tops of very tall trees; but the flight is not sustained, indeed it may be said never to fly far. It rests on the tops of leaves in the day-time, and is fond of the checkered shade on sunny days; it often comes to the ground on roads, paths and in beds of nalas to suck moisture in hot weather and is occasionally found at flowers. The butterfly is not found in the plains, but exists everywhere in the jungle-clad hills from sea-level upwards. The distribution is said to be Continental India generally, from the Himalayas to Travancore in the hills, avoiding the hot dry plains of Northern and Central India; Assam, Burma, Tenasserim, extending to China and Japan. The food-plants of the larva are certain fig-trees; those upon which it has been found are *Ficus religiosa*, Linn., the *Asvath* or *Pipal* and *Ficus bengalensis*, Linn., the common Banyan or *Wad*, both trees distributed throughout India and well known to everybody. There are three other species of *Cyrestis* known to the Indian Fauna and others in the Austro-Malayan region and Africa.

52. Junonia iphita, *Cramer* (Plate A, fig. 6).—Male and female *upperside* brown of varying depths of colour. Forewing: with one pair of subbasal and one pair of apical, transverse, sinuous fasciæ, the outermost defining the discocellulars; a short, broad, oblique fascia beyond to vein 4, its inner margin diffuse, its outer sinuous, but sharply defined; below vein 4, a sinuous transverse fainter fascia, followed by a discal blackish fascia, very broad and diffuse; below costa, bordered by a row of faint ocelli and a postdiscal and subterminal similar fasciæ following the contour of the termen. Hindwing with a slender blackish loop near the apex of cellular area; a broad inwardly diffuse, outwardly well-defined, short discal fascia in continuation of the one on the forewing; a series of postdiscal somewhat ochraceous ocelli with black pupils minutely centered with white; postdiscal and subterminal broad lines as on the forewing. *Underside* brown with very broad darker brown fasciæ the interspaces between the markings irrorated with purplish silvery scales. Forewing with two sinuous fasciæ on the basal half followed by a discal fascia, very broad at the costal margin and decreasing in width to the dorsum, bearing on its outer border a row of obscure ocelli. This is succeeded by a zig zag dark line and sinuous subterminal and terminal lines; apex and tornal area suffused with purplish silvery. Hindwing: two irregular dark brown, very broad, curved short fasciæ near the base; a straight, transverse, prominent, narrow ochreous-brown discal band defined outwardly by a black line; a transverse postdiscal dark-brown fascia, widest in the middle and bearing outwardly a curved row of ochreous-brown, white-centred ocelli, followed by a zig-zag dark line in continuation of that on the forewing; a subterminal somewhat diffuse dark fascia and a terminal dark line Antennæ, head, thorax and abdomen dark brown. The ground colour and even the markings vary in shade, some specimens being almost ochreous-brown, the ocelli often ochreous-ringed on the underside; the transverse discal fasciæ on the hindwing with one or two subcostal white spots, that in interspace 7 often large, and occasionally there is one in the same position on the subbasal transverse band. The *wet-season* insect, that is, the one appearing in the very wet months, is darker in shade than the *dry-season* specimens, and fresh individuals of that form often have the purplish silvery markings bright burnished steely blue in colour. The female also on the whole seems at all times to be lighter in shade than the male, especially on the underside. Exp. 56-77 mm.

Larva.—The shape of the larva is cylindrical, the anal end rounded and high; the body is set with seven longitudinal rows of spinous softish pedicels, one of each row to each segment 3-12. The head is square from front view, the face somewhat convex, divided into two lobes by a considerably depressed central line; surface covered with small white and yellow conical tubercles bearing each one hair, one tubercle on the vertex of each lobe being much larger than the rest and yellow, bearing a long hair; colour black-bronze with the vertex reddish. Segment 2 is not much narrower than the head and has a row of longish, erect, forward-curved hairs and a spiracular pair of small spiny tubercles above the base of the legs which (the tubercles) are about 1 mm. in length. Segments 3 and 4 have got these tubercles at bases of the legs also; segments 5 and 6 have got them in the place where the legs ought to be but here they are both at the same height instead of one below the other as in segments 2-4; segments 7-10 have them like these latter, segment 11 like the former. Segments 5-11 have a dorsal, subdorsal, lateral and spiracular spine-bearing pedicel, segments 3 and 4 only a subdorsal and lateral one, segment 12 has two dorsal ones, one near front margin, one near hinder margin (all the other segments having them in the centre) besides the subdorsal, lateral and spiracular ones; the 13th segment is plainly visible and has the subdorsal pedicels only; the anal segment only the lateral pedicel near the hinder edge. All the pedicels are swollen at base, of equal length except the ones at the bases of legs which are smaller; the spines are hair-like and disposed irregularly along the pedicels and each pedicel ends in a fine, conical hair-like spine with thickened base. Spiracles are rather small, shiny black, oval, raised. Surface of body covered with minute, conical, white tubercles giving it a velvety appearance. The colour is black and, when full grown, it is laterally reddish brown with an indistinct lightish spiracular line; dorsally, when full-grown, also, it has a reddish brown tinge with a yellowish shade because of the tubercles between the subdorsal pedicels of each segment; belly same colour as back; pedicels dirty watery yellowish, colour of spines brown. L: 38 mm.; B: 7 mm; L. of pedicels: 2 mm.

Pupa.—The pupa is of very ordinary nymphaline shape with slight conical protuberance in front of each eye, the surface with a few small conical tubercles the colour dirty grey-brown in shades. The head is square in front and blunt dorso-ventrally, each eye having a small conical tubercle in front of it pointing straight out in front; the lateral outline of pupa slopes slightly outwards from head to shoulders, then hardly at all as far as segment 7-8 after which the abdomen narrows to cremaster. The dorsal slope of segment 2 and thorax is the same and is about 45° to longitudinal axis of pupa;

the thorax is somewhat decidedly convex ; the constriction behind is dorsally considerable though wide, laterally very little ; the wings are not expanded at all ; on the shoulder is a slight transverse ridge and a short way behind is another ridge, below the wing-margin, at right angles to it. Spiracle of segment 2 narrow, raised, small, reddish ; the rest small, oval, raised slightly, light brown in colour. The stoutest part of pupa is about front margin of segment 7 and the height at apex of thorax is about equal to the breadth there. Surface smooth, finely aciculate (as if scratched with a needle), very slightly shiny ; a lateral small conical tubercle on thorax ; a dorsal one on its apex ; a dorsal, subdorsal, and lateral row on abdomen, one of each to each segment : none of them prominent, some obsolescent, especially the posterior ones. Cremaster stout, the dor al transverse section semicircular with two strong ventral extensor ridges. Colour a grey or dirty brownish-black ; a light spot on top of head and another on each side of front of thorax. L : 18mm.; B : 8mm.

Habits —The egg is laid among the young leaves, either on top or on the underside, really anywhere. The young larva commences feeding on the young leaves, lying among them generally putting out a few silks to protect itself by drawing the edges of leaves together although this is done in a very perfunctory manner. When full grown the larva lives anywhere on the plant : on the leaves, on the stem, anywhere. It is sluggish in its movements and drops to the ground, curling up when disturbed (so does the young one when handled or touched) but not by a silk. The pupation takes place generally somewhere near the ground on the underside of a leaf, from a stick, from the underside of a ledge of rock, &c., and the colour harmonises well with the surroundings of withered leaves, dead sticks and stones. The pupa is not particularly firmly attached, or perhaps it would be more correct to say that it is not rigidly attached for it hangs loosely and swings from side to side, but never falls off. The butterfly is one of the commonest insects throughout India both in the plains and hills from sea level upwards. Like all its near relations it does not rise much above the ground though it can fly quite a long distance at times. It is generally seen basking in the sun low down on a leaf with its wings half or wholly open and it does not frequent the ground as much as the other members of the genus. The flight is rapid, of the *Neptis* type at times, but more decided and much stronger. The insect rests with its wings closed over its back at night and, really, at all times when frightened and not actually basking or playing about. The larva feeds on a great number of plants of the family *Acanthaceæ* which is an order confined to the Tropics and containing some species which grow in great profusion where they exist, sometimes covering the ground for miles and miles with a dense growth of plants fifteen feet high and more (*Strobilanthes callosus* and others of the genus) in the hilly parts of India. Some of the species upon which the caterpillar has been found are *Strobilanthes callosus*, Nees. ; *Justicia micrantha*, Heyne ; *Asteracantha longifolia*, Nees., &c. The distribution is given as throughout Indian limits, extending to China and Sumatra.

53. **Junonia lemonias**, *Linn.* (Plate A, fig. 3).—Male and female *upperside* olive-brown. Forewing with four sinuous, short, black transverse bars across cell-area, the outermost defining the discocellulars; the space between the middle pair of these bars, two spots beyond the apex of the cell, an outwardly angulated, sinuous, discal series of spots, a postdiscal interrupted series of similar spots, yellowish or light ochraceous; also an ochraceous inner, subterminal, anteriorly broken line, inwardly margined with dark brown ; a large discal black blue-centred, reddish-ringed ocellus and a much smaller, very obscure, brown, subapical ocellus between the discal and postdiscal series of spots ; finally a dark brown terminal line following the outline of the margin. Hindwing with a slender black loop in the apex of cell-area, a large ocellus similar to the discal one of the forewing across interspaces 4. 5 and 6, often with its outer rings enclosing a much smaller ill-formed ocellus anteriorly ; postdiscal, subterminal and terminal dark brown somewhat lunular lines. *Underside* in the *wet-season form* ochraceous brown. Forewing : basal half crossed by three broad, pale, dark-edged, sinuous bands, beyond which the angulated discal, the postdiscal, subterminal and terminal markings of the upperside show faintly through ; the discal ocellus as on the upperside but not so clearly defined and without the blue centre. Hindwing with three or four sinuous, ill-defined, band-like, pale markings on the basal half, the outer faint bands coalescing ; followed by a postdiscal dark broad band traversed by a row of minute dots interrupted by two large black ocellar spots, and a faint subterminal, lunular, brownish line. In the *dry season form* the ground-colour is ochraceous yellow, often ochraceous red, the markings more obscure, the two large black ocellar spots reduced to the size of the others in the row. Antennæ, head, thorax and abdomen dark brown ; beneath, the palpi, thorax and abdomen pale dull ochraceous. Exp. 56-62mm.

Larva.—The shape and arrangement of spines is the same as that of *J. iphita* exactly. The head is bilobed, roundish, with the sides more or less parallel to each other ; shiny metallic dark blue in colour with a stout short tubercle on vertex of each lobe. The colour of body is pale black with a deeper black dorsal line; there is no subspiracular line ; all the tubercles or pedicels of spines are metallic blue, the spinules dark ; the two tubercles or spines in front of spiracles of segment 2 are red-yellow as is also the neck. Surface of body covered as usual sparsely with minute, whitish, setiferous tubercles. Spiracles oval, dull black, flush, of ordinary size. L: 36 mm.; B: 7 mm.

Pupa.—There is nothing much to distinguish this from that of the preceding species in colour or size so that no particular description has been kept.

Habits.—The habits of the larva are much the same as those of *J. iphita* and the method of pupation and choice of locality also. The style of flight of the imago is also similar as well as the other habits. This species is, perhaps, less fond of absolute plain country than either *J. orithya* or *J. hierta* and is certainly not as numerous as any of the other species where they are found; it is more an insect of the jungles than any of the others except *J. iphita*, though this does not mean that it is anywhere confined to those jungles. The foodplants—for there are probably many—all belong to the same family as those of the last species. Plants the caterpillar has been found on are *Nelsonia campestris*, R., and *Asteracantha longifolia*, Nees., the former a diffuse herb spreading over considerable areas in the jungles, with sticky or glutinous leaves and flower-bracts, the latter a herbaceous plant growing in damp places, with whorls of sharp thorns, lanceolate leaves and blue flowers, very common; both of them distributed throughout India as is also the butterfly.

54. **Junonia atlites,** *Johansen.*—Male and female *upperside* pale lavender-brown, apical half of the wings paler. Forewing: cell with three transverse, short, sinuous, black bands, the outermost defining the discocellulars; a similar short, somewhat broader band beyond apex of cell; two transverse discal dusky black fasciæ, the inner highly sinuous and outwardly angulate above vein 4, the outer straighter, somewhat lunular, bordered by a series of whitish ovals with dusky or black centres; the black-centred spots in the interspaces 2, 5, 6 margined inwardly with rich ochreous yellow. Beyond this series of ovals is a lunular narrow transverse dark band followed by sinuous subterminal and terminal dark lines. Apex of wing and terminal margins, more or less broadly, slightly fuliginous; cillia grey. Hindwing: a short slender black loop from vein 6 to 4 at apex of cell area; two discal sinuous transverse dark-fasciæ in continuation of those on the forewing; followed by a series of dark-centred ovals in interspaces 2-6, those in interspaces 2, 5, 6 with dark centres inwardly bordered broadly with ochreous yellow; postdiscal, subterminal and terminal dark lunular lines as on the forewing. Cilia grey. *Underside* lilacine white, marking as on the upperside but very delicate, slender and somewhat obsolescent. In the *dry season form* of the male the rows of oval ocelli are only indicated by the yellow-centred ovals. The most prominent marking is the inner discal fascia across the wings; this is much less sinuous than on the upperside and not angulated on the

forewing. In the females the markings are all heavier and more distinct, the space between the various transverse fasciæ tinged with ochraceous. Exp. 55-66 mm

Egg.—The egg is barrel-shaped, with thirteen longitudinal ridges from top to base parallel to each other and not continued on to the flat top ; these ridges under the lens are finely beaded and are thin, being one-fifth as broad as an interspace at the middle of the egg ; the flattish top has a small white ring in the centre—the micropyle ; the surface is otherwise shiny and smooth ; the colour is dark green with all the ridges white.

Larva.—The larva resembles in shape that of *J. iphita* or any other member of the genus, the position of the spinous pedicels is also the same. These spinous pedicels are : on segment 2, below the spiracle, on base of leg, two of them one above the other ; two at the same height, beside each other, on segments 3 and 4 in the same position ; a triangle of three on segments 5 and 6, where the base of the leg would be : two in a horizontal line and one below ; two in a line on base of pro-legs of segments 7-10 ; two one below the other on segment 11 ; and a single one subspiracular and slightly larger, on segments 3-12; all, except these last, dirty watery-white in colour and set with fine white hairs as long as the pedicels in the subspiracular line ; beside these pedicels there are : a dorsal, dorsolateral, supraspiracular pedicel on segments 5-11 ; a dorsolateral and supraspiracular one on segments 3 and 4; a dorsolateral pedicel on segments 13 and 14 ; two dorsal ones on segment 12, one near front margin, one near hinder margin, as well as a dorsolateral and supraspiracular one ; all these pedicels above the subspiracular ones are of the same length, just under 2mm., are shiny blackish in colour and have two whorls of dark yellow-brown spinelets on them, these spinelets being nearly as long as the pedicels themselves ; segment 2 has ten simple, slightly-forwards curved spinous hairs along the front margin, black and rather long. Surface of body is soft looking and covered besides with 1mm. long fine, pure white hairs, each hair springing from a minute, pure white, circular tubercle (in these hairs lies the difference from all other *Junonia* larvæ mentioned). A narrow dorsal line and the whole dorsum of segment 3 have no white hairs. Spiracles are oval, black, with shiny borders. The anal flap is nearly semi-circular in outline and somewhat thickened at extremity where it is yellow-ochreous in colour. Head rather small, squarish, the vertex indented triangularly, making it somewhat bilobed ; the vertex of each lobe bears a conical, shining, ochreous tubercle surrounded by three or four small ones, each bearing a hair ; the hair of the large one always long and white ; another small tubercle in the centre of each lobe-face ; some stiff black hairs on upper part of face, some soft white ones about the base ; colour of the head dark bronzy blackish brown with rather a large, triangular black clypeus ; labrum colourless ; basal antennal joint ochreous, second joint blackish. Neck dull greenish black. The colour of the body is velvety black looking, under the lens, somewhat shiny greenish-black ; abdomen lighter blackish ; a subspiracular band sending a short spur up and forwards in front of each spiracle, legs and prolegs all brownish ochreous. The whole larva appears frosted-white on account of the presence of the small white hairs. L: 40mm.; B: 5mm.

Pupa.—The pupa is almost exactly the same shape as that of *J. almana* in every way; it differs mainly in the colour which is a dull light brown throughout with the front faces of the tubercles somewhat darker and the hinder faces somewhat lighter than the ground-colour; head-points, apex of thorax and cremaster dark brown; hinder half of segment 8 lighter than ground-colour; the apex of thorax is more pointed than that of *J. almana* being a conical point; the anterior dorsal slope from apex to front of pupa is straight instead of convex as in that species; the cremaster is smoothly triangular and has no tubercles; the whole pupa is slighter. Spiracles of segment 2 indicated by a small semicircle of a light red-brown colour on the surface of front margin of segment 3; the other spiracles are rather narrow, black, somewhat raised ovals. The body is somewhat constricted about segment 5. L: 17·5 mm.; B: 6·25 mm. at shoulders and at segment 8.

Habits.—The habits of the full-grown caterpillar are very similar to those of *Junonia orithya* in that it feeds upon low or procumbent plants and is generally found lying full-stretched on a perpendicular stem or stalk. The egg is laid on a stalk of grass, on the dead stem of a plant, anywhere in fact as the foodplants grow in great abundance in the spots chosen for ovipositing; the little larva finds the proper plant without any trouble and lies on the undersides of the leaves low down, and drops to the ground curled up when touched, remaining for a considerable time in that position before it regains confidence to move again. The pupa, as a rule, is affixed to a stem or leaf in some thick place, where the plants are close together and mixed with many other species, and, like the larva, is not easy to find. The butterfly moves very much like the other members of the genus, keeping much to the ground, and is fond of visiting flowers; it is a somewhat weaker insect than any of the other species, and is not found much in the jungles, keeping chiefly to the open rice-fields and cultivated lands, especially where the ground is moist in the neighbourhood of tanks and ponds; it is commoner at sea-level from Thana southwards in the Bombay Presidency than anywhere else and is scarce in the jungles of the hills. The distribution is the Terai at the foot of the Himalayas from Kumaon to Sikhim; Eastern Bengal; Central Provinces; Kanara; Ceylon; Assam; Burma; Tenasserim; extending into the Malayan subregion. The foodplants are acanthaceous like those of the other members of the genus; those the larva has been found on are *Asteracantha longifolia*, Nees., and a species of *Barleria.*

55. Junonia orithya, *Linn.* (Plate A, fig. 4 ♂, 4*a* ♀).—Male *upperside* ; somewhat more than half forewing from base velvety black, apical half dull fuliginous ; cell area with or without two short transverse orange bars ; a blue patch above the tornus ; the outer margin of the basal black area obliquely zigzag in a line from the middle of costa to the middle of vein 3, thence straight, then incurved to middle of dorsal margin ; just outside it, between veins 2 and 3, a large ocellus, often obscure and surrounded by a margin of the basal black area, sometimes prominently ringed with orange-yellow. Beyond basal black area is a broad, white, irregularly oblique, discal band followed by a short, oblique, preapical bar from costa ; a small black orange-ringed ocellus beneath the bar ; a subterminal continuous line of white spots in the interspaces and terminal jet-black, slender line, appearing double in some specimens; cilia alternately dusky black and white. Hindwing blue-shaded with velvety black towards the base; a postdiscal black and white or blue and white-centred orange, black-ringed ocellus in interspace 2 ; another, minutely white-centred or not, similar to this or completely black, round or oval, sometimes completely wanting, in interspace 5 ; the termen narrowly white bordered inside by a black line limiting the blue area and traversed by a slender black line parallel to the black termen ; cilia white. *Underside* forewing : basal half with three black-edged, sinuous, broad, ochraceous-orange transverse bands, followed by a pale discal band ; ocelli, preapical bar, subterminal and terminal markings, much as on the upperside ; the discal band margined inwardly by a broad, black angulated line, which follows the outline of the black area of the upperside, here replaced by pale grey. Hindwing irrorated with dusky scales on a greyish ground, crossed by transverse subbasal and discal, slender, zigzag, brown lines and a postdiscal dark shade on which are placed the two ocelli as on the upperside ; and sometimes a black dot in each interspace 3 and 4; subterminal and terminal faint brown lines and a brownish short streak tipped black at the tornal angle below the lower ocellus. Female similar, with similar but more clearly defined, larger ocelli and markings ; the basal half of wings on the upperside fulliginous brown, the blue on hindwing sometimes obsolescent, though this is only found in specimens from dry regions, those from places of heavy rainfall always having the blue developed. Antennæ brown, the upper surface white in the males ; head reddish brown, thorax and abdomen above black ; palpi, thorax and abdomen beneath dull white. Exp. 49-62mm.

Larva.—The caterpillar is of the same type as the rest of the genus. Head roundish, bilobed, each lobe surmounted by a short, equilateral, conical tubercle, the two diverging ; surface shiny, covered with small, white, truncated-conical tubercles from each of which arises a curved, shiny, black, rather long, stout hair ; the lobe-vertex tubercles, have lateral spinules or bristles; clypeus of ordinary size, triangular, with the apical third orange ; basal antennal joint light, second joint black ; colour of head otherwise black.

Segment 2 has a row of six tubercles on the front margin of which the lowest, subspiracular, is the longest and stoutest; the next is the smallest and situated in front of spiracle; the subspiracular and spiracular tubercles are yellow, the rest shiny black and spined. Segments 3 and 4 have a dorso-lateral supraspiracular and subspiracular tubercle or spine-bearing pedicel; segment 12 is similar but has 2 dorsal pedicels, one near hinder margin, one near front margin; segments 13 and 14 are each provided with a dorso-lateral pedicel. Segments 5-11 are similar to segments 3 and 4, but have a dorsal pedicel in addition. The little spines on the leg-bases are the same as described for *J. atlites.* All the pedicels are stout, longly conical, rigid, about 1 mm. in length and covered sparsely with irregularly disposed spinelets: all shiny blue-black, the extreme bases of the front subspiracular ones of segments 3 and 4 ochreous. Spiracles are large, oval, raised with light centres and shiny black borders. Body surface covered with minute erect, black hairs. The colour of the larva is leaden black, with the neck orange; a jet-black, narrow, dorsal band, spotted finely with white; a white dorsolateral and supraspicular small spot on the hinder margin of each segment; the bases of supra and sub-spiracular orange-surrounded tubercles are bordered above with yellowish white; there is a yellow-white, narrow band running along and beneath the subspiracular tubercles the whole length of body; the whole spiracular region is sparsely spotted with white: all these white spots mentioned are tubercular, that is, are slightly raised and each bears a little hair; true legs shiny black; prolegs blackish with an orange shade; the belly is blackish purple. L: 30 mm.; B: 5mm.

Pupa.—Pupa is very much like the rest of those of the genus. It is perhaps somewhat slenderer than those of *J. almana* and *J. iphita.* It is more or less concolorous, being a slatey dull grey all over. In size it is somewhat smaller than the other species.

Habits.—The larva has the habits of the genus; the full grown larva is found in the early mornings lying along the stalks and stems of upright plants in the places where its foodplant exists, for the plant or plants it feeds on are generally fairly abundant in those localities; it probably feeds mainly at nights and retires to some hiding place amongst the leaves and stems on or near the ground during the heat of the day. The pupa is formed generally against the side of a stone or rock low down, sometimes from a stalk or leaf, but this, it has been observed, more rarely: this is due probably to the perishable nature of the foodplants. The butterfly is found most commonly in the open plains, frequenting chiefly flat, stony, more or less uncultivable lands, especially flat, wind-swept, low plateaux of the plains. It is a strong, fast flier, but rarely rises high above the ground, where it invariably rests; nor does it fly far at any time.

It is, like most of the *Junoniæ*, fond of visiting flowers and the female oviposits generally on leaves lying on the ground or very close to it or on flower-heads, the foodplants being small, low or procumbent or creeping herbs, some of them with very hard, rough leaves. These plants are all belonging to the family *Acanthaceæ* as usual for the genus ; and those of them upon which the caterpillar has been found are *Justicia procumbens*, Linn.; *Justicia micrantha*, Heyne and *Lepidagathis prostrata*, Dalz.; this last growing on bare rocks in extensive patches, the second on paths in fields and open places, slightly taller and less creeping than *Lepidagathis* and more succulent, with little mauve flowers ; the first somewhat similar, flowers pale violet-pink ; all of them very common in Western India ; *Justicia procumbens* spreads to Ceylon, Malay, and Australia, *Lepidagathis* occurring also in the sub-tropical Himalayas. The distribution of the butterfly is India, Ceylon, Assam, Burma, Tenasserim, extending to China and the Malayan subregion.

56. Junonia hierta, *Fabricius* (Plate A., fig. 2, ♂).—Male *upperside* bright yellow. Forewing : the costa with a broad triangular projection downwards at the discocellulars, which may be sometimes wanting, the apex broadly, the terminal margin and the dorsum with a triangular projection upwards near the tornus, jet black ; this black margin narrows near the middle of the termen and bears, on the apex, two short, transverse, preapical white streaks crossed by the black veins, below the inner one, an obscure ocellus which may be sometimes wanting. Hindwing : anterior half, and the terminal margin black, the dorsum broadly shaded with ochraceous brown, the anterior black area with a large brilliant blue central patch. Cilia of both wings, white alternated with brown. *Underside* : forewing pale yellow ; cell crossed by three black margined orange-yellow bands ; beyond the cell a short, broad, irregular, jet-black (sometimes dusky-brown) oblique band from costa to base of vein 4 ; apex and dorsal margin broadly, termen in the middle narrowly dusky brownish black with some obscure paler markings ; a round jet-black discal spot in interspace 2 and another smaller one in interspace 5. Hindwing greyish yellow ; in the *dry season form* strongly irrorated with dusky scales ; a prominent transverse brown discal fascia, its margins highly sinuous, a broad brownish shade on the middle of termen ; some obscure lunular marks on the basal area, a postdiscal line of minute dots, in the *rains form* sometimes becoming ocellus-like, subterminal and terminal zigzag slender lines, pale brown. Antennæ pale, head, thorax and abdomen dark brownish black ; beneath dull ochraceous white. Female similar, the colours duller. *Upperside* forewing : cell with a more or less complete black fascia and another at the discocellulars ; blue-centred, well-marked ocelli in interspaces 2 and 5 on the disc of the forewing and smaller ocelli in interspaces 2 and 5 on the disc of the hindwing. Fore and hindwings with a fairly well-defined subterminal pale line, the blue spot on the anterior black area of the hindwing smaller, with a lilac shade and more ill-defined or entirely wanting ; the rest as in the male. *Underside* as in the male, but generally with the markings heavier and more clearly defined. Exp. 50-58mm.

Larva.—The caterpillar is similar to those of the other *Junoniæ* in shape and in the disposition of the spines. Head covered with minute, conical yellow tubercles, each bearing a seta on the summit, some few setæ rather longer than the rest, some few tubercles on vertex of each lobe slightly larger than the rest, one in particular larger, yellow, bearing a long white seta on it ; colour brown-yellow suffused with black in front ; inside the semi-circle of eyes it is also black. The anal flap ends in a "boss" which is rugose. Spiracles black, shiny, oval. Surface of body covered with very minute, shortly setiferous, conical, yellow, tubercles. Segment 2 has a subspiracular longish pedicel, a small supraspiracular one and a row of four small, setiferous black tubercles down the centre on each side. The colour of the body is light greenish-brown, the major part of dorsum of segments 3 and 4 velvety black as also the hinder part of segment 2, there being a double yellow line behind the black of each segment, this yellow broadest on segment 3 ; a sometimes obsolescent black dorsal line ; a blackish patch round the bases of subdorsal tubercles of segments 6-12 ; belly concolourous with dorsum ; all the spinous pedicels (nearly equal in size, about ½ breadth of head) are black in colour set with sparse brown spinelets ; all the true legs and prolegs are dirty light brown, the former with black claws. L : 37mm. ; B : 6mm.

Pupa.—Is long and rather narrow, coloured a sort of greyish brown-red. Head, segment 2 and thorax together have the same dorsal curve from front of pupa to apex of thorax, that is, that part of the pupal dorsal line is inclined at about an angle of 45° to the longitudinal axis ; the thorax is somewhat humped and evenly convex ; constriction behind thorax very moderate ; abdomen circular in transverse section, thickest at segment 7, gradually decreasing to end, the two last segments—segments 13 and 14—being nearly at right angles to the rest of body ; the 12th is suddenly a little narrower than the 11th ; the cremaster is very stout, flattened above and below, narrowly depressed in ventral line, triangular in shape and of the same width as segment 13 at base. The ventral line of pupa is straight. Head is square in front with two small points, one in front of each eye, the pupa broadening out evenly as far as shoulders, where there is a small projection after which the lateral line along the wings is slightly concave ; the edges of wings (dorsal margins) are very slightly expanded. Surface of pupa is somewhat rough under the lens ; there is a row of very small dorsal tubercles on abdomen, increasing in size backwards and a subdorsal row of larger ones as well as a lateral row like the dorsal one, one tubercle of each row to each segment ;

there are none on segments 12 and 13 ; on thorax, near hinder margin, there is a subdorsal tubercle. The colour is greyish brown-red with the wings, posterior portion of segment 8 and segment 12 lighter than the rest. The colour is nearly black sometimes with the light parts nearly white. L : 16mm. ; B: 6mm.

Habits.—The habits are very much the same as those of *Junonia orithya* in the larval and pupal states as well as for the imago. The latter is found in the same localities as *J. orithya* preferring, perhaps more protection from wind and rain ; it is fond of sitting on paths and open ground with its wings spread to the sun and does not rise far from the ground though it is a quick strong flier. When not basking it rests with its wings closed and is then not easy to see, herein also resembling *J. orithya*. The butterfly is not plentiful in hilly, jungly country, but is common in many parts of the open plains. The larva feeds on *Acanthaceœ* ; it has been bred on *Asteracantha longifolia*, Nees. The butterfly is found throughout Indian limits and extends to China.

57. **Junonia almana**, *Linn.* (Pl. A, fig. 5).—*Dry season form.*—Male and female *upperside* rich orange-yellow. Forewing with a pale dusky and a much darker, sometimes bluish, short, transverse bar with jet-black margins across cell, another somewhat similar bar defining the discocellulars ; costal margin, an inner and an outer subterminal line and a terminal line, dusky black ; a large minutely white-centred bluish ocellus ringed by slender ochraceous line and bordered by black in interspace 2 ; two similar but geminate ocelli with an obscure pale spot above them and a short oblique black or dusky bar connecting them to the black on costa. Hindwing : a small minutely white-centred and very slenderly black-ringed plum-coloured or bluish ocellus in interspace 2, with a large yellow and black-ringed ocellus spreading over interspaces 4, 5, 6, the centre inwardly brownish orange or bluish plum-coloured, outwardly blue and black, with two white spots one below the other between the two colours ; then postdiscal, subterminal and terminal black sinuous lines. *Underside* ochraceous brown, often with a violet bloom, very variable in shade. In most specimens the cell of the forewing is crossed by three dark sinuous bands, the outermost along the discocellulars ; these are very faint in some ; both fore and hindwing crossed by a basal and a discal pale sinuous line margined outwardly by a dark shade which is traversed by an obscure, somewhat obsolescent row of dark spots and outwardly bounded by a subterminal pale sinuous line, the dark shade in many cases spreading on the forewing to the terminal edge of the wing ; on the hindwing the subterminal line meets the discal in an acute angle at the tornus ; the veins are generally slenderly ochreous on the basal half of wings, the cilia also slightly ochreous. Antennæ dark brown ; head, thorax and abdomen more or less orange-brown ; paler beneath.

Wet season form.—Male and female *upperside* similar, the black markings deeper in colour and heavier, the subterminal and terminal lines more clearly defined, the veins narrowly dusky. *Underside* pale ochraceous. Forewing: cell crossed by five sinuous dark-brown lines, a similar line on the discocellulars and another beyond it, both bent inwards at an angle and continued to the dorsum, the space between them forming a discal broad fascia paling to whitish posteriorly ; the post discal ocelli, subterminal and terminal lines as on the upperside but paler, Hindwing: a slender transverse, subbasal, dark line and a discal, whitish, straight fascia in continuation of the one on the forewing; the postdiscal ocelli, the subterminal and terminal lines much as on the upperside but paler ; the anterior ocellus with a double iris and centre. Antennæ dark brown ; head, thorax and abdomen as in the dry-season form but slightly darker. Exp. 54-62 mm.

These two forms do not only differ very strongly as to the colour of the underside and superficially, in the pattern there, but also in the shape of the wings ; the forewing in the *dry-season form* acquiring a very prominent hooked apex ; the hindwing a considerable access to the length of the tornal angle or tail; the full *wet-season* insects have neither the hooked apex nor the tail, though of course there are many intermediate ones born at the change of the seasons.

Larva.—Shape like the other *Junoniæ* ; arrangement of spines also the same. Head broad, heart-shaped, as broad as high ; surface shiny, covered with minute white, setiferous tubercles, setæ white ; on vertex of each lobe is one larger yellow hair-bearing conical tubercle as also some smaller ones of the same colour ; a few black bristles on back margin ; colour of head black, apical half of clypeus orange. Spiracles large, oval, shiny black. Surface of body covered with minute white, setiferous tubercles, the setæ black ; the surface velvety looking ; the segmental membrane are brownish and without tubercles. Segment 2 with a collar of simple erect black hairs, a subspiracular sharp spiniferous pedicel and a smaller one on base of leg. Anal flap ending in a round, shiny black boss. Segments well marked. Segment 12 has the two dorsal spines, a supraspiracular and subspiracular one but none on the ventral face laterally as usual. The colour of the body is smoky black, the neck is orange, the belly brownish, an obsolescent brownish subspiracular line ; the spine-bearing pedicels black with dirty light orange spines with black tips to them. L: 41mm.; B: 5·5mm. ; L. of pedicels : 2mm.: all of the same length except those on base of legs which are smaller.

Pupa.—Is of the usual type. Head square in front, half as long as broad (length in the sense of pupal length), with a small, rather broad, rounded, short point in front of each eye ; vertex convex. Segment 2 the same length as head with the front margin bent back in a small sinus towards hinder margin. Thorax broadly and very slightly convex, the slope of dorsal line at front margin being in a plane at right angles to longitudinal axis of pupa, its apex hardly higher than segment 4, its hinder margin a slight curve ; it is carinated very slightly in dorsal line. The shoulders are slightly angulated with another small tubercular point at origin of wing. The constriction behind thorax moderate dorsally, wide and shallow laterally ; wing expanded ever so slightly between the shoulder-tubercle and the one immediately behind it. Pupa stoutest at segment 7/8 ; section of abdomen circular with the line of junction of wings slightly prominent. Segment 12 suddenly narrower than segment 11 ; segments 12-14 very short ; cremaster stout, short, square, with strong ventral extensor ridges ; hair-hooklets at very extremity. Spiracular expansions of segment 2 represented by little linear orange bodies, hardly prominent ; the spiracles dull black, oval, rather small. Surface finely roughened ; velvety looking ; a dorsolateral conical tubercle on segments 3-11, those on segments 4, 6-8 rather large ; a lateral and subspiracular similar, smaller tubercle on segments 6, 7 and 8. Colour dark greyish green with black and cream-coloured markings ; cremaster dark greasy-looking, red-brown ; a broad band on hinder margin of segment 11 interrupted ventrally, two parallel longitudinal ventral bands, a band on posterior margin of segment 8 continued by a broad diagonal light brown band on wing, the posterior side of all dorsolateral tubercles except those of segments 9 and 10, some markings on segments 1-3, a dorsal blotch on segments 9 and 10, the underside of head : all cream-coloured. L : 20mm. : B : 7·5mm.

Habits.—The egg is laid on the underside of a leaf ; the larva lives there, eating continuously and when full grown may be found anywhere on the plant. The pupa is formed on the underside of a leaf, stalk or stem, or elsewhere, hangs freely and is firmly fixed. The colour of the pupa is liable to little variation, the markings to none. The butterfly is very common, possibly the commonest of the *Junoniæ* in India and sometimes exists in great numbers in certain localities. It is not quite so common in the jungles and hills as in the plains but on the coast in the Konkan, just along the very base of the ghats, it occurs very abundantly in the end of the monsoon, frequenting the neighbourhood of tanks and ponds, the banks of rivers, wet rice fields, &c., where its food-plants or, properly speaking, certain of its food-plants grow in profusion. One of these on which it is commonly found is *Asteracantha longifolia*, Nees., others are *Hygrophila*, *Barleria* of different species, and doubtless there are many others. All of them belong to the family *Acanthaceæ*. The butterfly is a strong flier, but, like the others, never goes very far without settling, basks with its wings open, but rests with them closed and nearly always on the ground, often settling, when put up, after a short flight among leaves and rubbish, after the manner of a *Melanitis*, sideways, showing the whole surface of the underside of wings. This is, no doubt, the reason why the dry season forms have the wonderful leaf-pattern, varying in shade so much on the underside, the produced hooked apices to forewing and tail to hindwing which blends so well with withered leaves. It is difficult to imagine any other reason for the complete change that comes over the form and markings of the insect than one having its origin in a desire for protection. The butterfly is found throughout Indian limits; also in China and Japan and in the Malayan subregion.

The pupæ of all the *Junoniæ*, when touched, move the body from side to side with a slightly jerky motion, the bending taking place in segment-margins 8/9, 9/10, 10/11, and each jerk produces a knocking sound destined, there is little doubt, to frighten small enemies, such as flies, spiders, perhaps even lizards and small birds. It is distinctly audible at close quarters.

The genus *Junonia* exists in the tropics of America, in Africa, India and Australia and even further eastwards.

The Plates A, B and C have been published in Vol. XVI of the Journal, No. 4; and Vol. XVII, Nos. 2 and 4. On second thoughts, it has been thought advisable to re-write the descriptions of the butterflies formerly published, notwithstanding what was said in paragraph 5 of the present papers begun in the number issued on the 15th April 1909.

ERRATA.

[In the last part of this paper (No. 3, Vol. XIX). the following *errata* occurred]:—

Page 636, instead of *Moduza procis* ... read ... *Moduza procris.*
under figure 9.
Page 636, instead of *Cufa phacida* ... read ... *Cupha placida.*
under figure 10.
Page 638, instead of *Neptis cunyome* ... read ... *Neptis eurynome.*
under figure 13 and
instead of *Euthalia lepidca* ... read ... *Euthalia lepidea.*
under figure 14; also, in the
same line instead of *occillus* ... read ... *ocellus.*
Page 639, instead of *Eulapis* ... read ... *Eulepis.*
in line 14.
Page 640, instead of *lubentine* ... read ... *lubentina.*
in line 24; and
instead of *Mussoenda* ... read ... *Mussœnda.*
in line 38.
Page 646, instead of *hyperbious* ... read ... *hyperbius.*
in line 2.

Also add to Explanation of Plate facing Pl. II. (Larvæ).
"(All moth larvæ)" under '———' and above 'Fig. 32.'

SOME NOTES ON THE GIANT SQUIRRELS OF INDIA, BURMA AND CEYLON.

BY

R. C. WROUGHTON, F.Z.S.

I had occasion recently to lay out, for comparison, all the specimens of this group, in the Collection of the Natural History Museum, S. Kensington, and to look up all the original descriptions of species.

It seems to me that the publication of a few notes of the result of my examination would not only be of interest to members but might induce some of them to obtain and present specimens through this Society, to the National Collection, to help to fill up some of the important gaps in that series.

Blanford, in his 'Mammals,' recognised three species, *viz.*, *Sciurus indicus*, *S. bicolor* and *S. macrurus*. He there merely referred to varieties, which occur in all three of these forms, without exactly differentiating them, but, later, in the Journal of this Society (1897, Vol. XI, p. 300), he accepted 4 forms of the first species mentioned above under the names—(1) *S. indicus* (s.s.) ; (2.) *S. indicus malabaricus* ; (3) *S. indicus bengalensis* ; and (4) *S. indicus dealbatus* : the last two names were given by himself on that occasion.

In more recent years these Oriental Giant Squirrels have been separated from *Sciurus*, in a genus by themselves, under the name of *Ratufa*.

The members of this genus seem to be particularly plastic under changes of environment, but at the same time the variation seems to be quite uniform, under the same local conditions. Consequently, we seem to find a form in a comparatively quite small local area differing, slightly it may be, but, nevertheless, definitely and constantly, from all its neighbours of the surrounding area, yet no intermediate stages bridging this difference are forthcoming. The material at my disposal for examination is insufficient to enable me to confidently state this to be the case, but it is undoubtedly shadowed forth by the case of *Ratufa indica*. Between the (practically) self-coloured *indica* of the northern part of the Western Ghats and the much blackened *maxima* of Travancore, etc., we have Blanford's *bengalensis* of the Ganges Valley. But I believe that when we have specimens from a sufficient number of localities it will be found that there is a paler and a darker form of what is now typical *indica*, each limited to its own district. And that the Mysore form, intermediate between *bengalensis* and *maxima*, will be found to be constant for its own area and therefore worthy of a name, equally with the other races. This is one of the questions I would ask members to help us to solve.

Blanford recognises as inhabiting Ceylon a grizzled species *S. macrurus* (it should be *macrourus*) and a black variety *S. tennantii* (it should be *tennenti*), but, by some error, he has transposed the names. True *S. macrourus* is the black form and the grizzled one is *tennenti*. It is true that Kelaart states the brown and grizzled forms to be seasonal ones, but I have grave doubts of this; the analogy of changes elsewhere would point to the brown as a seasonal form of the black, if of any, but we have several instances in the genus of just this difference separating definable local races. Here again members can help with dated and exactly localised specimens and notes.

Jerdon and others state that the grizzled form (*R. macrourus tennenti*) is also found on the mainland as far north as Travancore and the Nilgiris. There is a specimen labelled as from the Shevroy Hills in the National Collection, but specimens, exactly localised and dated are badly wanted, not only to prove the existence of this species on the Mainland, but also, that being proved, to show whether it and *maxima* occur together or have separate defined habitats.

The Giant Squirrel of the trans-Gangetic region is recorded by Blanford as *bicolor*, but this is most certainly a misnomer; that name was given to the very distinct form found in Java. The name I have adopted in this paper, viz., *gigantea* was actually based on specimens from Assam. Unfortunately, the National Collection has no specimens from Assam, though it has quite a nice series from Sikhim and Nepaul of the dark-brown western race *macruroïdes*.

I had hoped at first to deal, in this paper, with the whole genus, but so many forms, which I have never seen, have been named by American naturalists, from Sumatra and the Malay Archipelago, that I had to give up the idea. I have, however, included in these notes the forms of the Malay Peninsula.

Blanford lumps together the large black Assam *gigantea* and the smaller Malay *melanopepla*, two forms which are markedly and constantly distinct in severalother characters besides size. The latter, the type locality of which is Trong in Lower Siam, is undoubtedly found in Tenasserim (it extends also southwards through the Malay Peninsula and beyond), but how far north it meets *gigantea* or whether there are local races of either in Middle Burma we do not know, for we have no specimens from between the extreme north of Upper Burma, about Bhamo, and the extreme south of Tenasserim.

Further, at Trong, a quite distinct form (*pyrsonota*), closely allied to the *R. affinis* of Singapore, is found together with *melanopepla*. Whether this species extends, changed or unchanged, into Burma, we have no means of judging.

The very 'scrappy' nature of our National Collection of working specimens of Indian Mammals is greatly to be deplored, and I trust means will be found in the early future to remedy it, but in the meantime, I venture to think that it is 'up to' the members of this Society to lend a hand to close up some of these gaps, which I have indicated.

The following is a key to the species and sub-species which in my opinion should be recognised, so far as present material enables us to judge.

Key to the Genus *Ratufa* as represented in India, Burma and Ceylon.

I. Ears tufted (India, Ceylon ? N. Burma).
  A.—Size smaller (Hindfoot = 75 ;* Skull = 67). Lower portion of legs yellowish white. Feet (or at least toes) black. (Ceylon, S. India).
    a. General colour black......... (1) *macroura*, Penn.
    b. General colour dark bay ... (2) *m. ceylonica*, Erxl.
    c. General colour grizzled ... (3) *m. tennenti,* Blyth.
  B.—Size larger (Hindfoot = 77—80, Skull = 72—75.)
    a. Tip of tail and vertex between ears white or pale buff.
      *a*¹. General colour yellowish buff (Surat Dangs)..................... (4) *dealbata*, Blanf.
      *b*¹. General colour hazel or bay.
        *a*². Tail red ; no black markings.

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* Measurements in millimetres.

on body. (Western Ghats from Kanara to Bombay) ... (5) *indica*, Erxl (s.s.)

b^2. Tail black; rump and thighs blackish. (S. Ganges Basin)........................ (6) *i. bengalensis*, Blanf.

c^2. Tail black; forelegs, shoulders, rump, hindlegs and oftenest a median dorsal line black (Malabar) .... (7) *i. maxima*, Schreb.

b. No white markings on tail or head. Pale colour of inner side of forelimbs never extending over front of forearm.

a^1. Colour above black (Assam, N. Burma)........................ (8) *gigantea*, McCl. (s.s.)

b^1. Colour above dark brown (Nepal, Sikhim) .... (9) *g. macruroides*, Hodg.

II. Ears not tufted (Tenasserim, Lower Siam, Malay Peninsula, &c.)

A.—Shoulders, forelegs and thighs black or at least dark brown. Pale colour of inner side of forelimb spreading over front of forearm—

a. Whole upper surface black.

a^1. Colour of lower surface paler, 'ochraceous' on belly, fading to yellowish buff on throat and inner side of forelimbs.

a^2. Skull wider, zygomatic breadth at least 44 mm.

a^3. Size smaller (Hindfoot = 74 ; Skull = 70) (Lower Siam and Malay Peninsula) ....(10) *melanopepla*, Mill. (s.s.)

b^3. Size larger (Hindfoot = 76 ; Skull = 72) (Anambas Islands) .. .. (11) *m. anambæ*, Mill.

b^2. Skull narrower, zygomatic breadth, 41. (Natuna Islands) ... . (12) *m. angusticeps*, Mill.

b^1. Colour of lower surface darker, at least 'tawny' on belly, fading to 'ochraceous buff', palest on throat and inner side of forelimbs.

a^2. Larger (Hindfoot = 75 ; Skull = 72·5) (Islands of Malacca Straits)................ (13) *m. fretensis*, Thos. and Wrough.

b^2. Smaller (Hindfoot = 72 ; Skull = 68·4) (Tioman Island) .... (14) *m. tiomanensis*, Mill.

b. Shoulders, forelegs and thighs darker than rest of body.

a^1. Pale patch on vertex between the ears; tail pale yellow (Java), (15) *bicolor*, Sparrm.

b^1. No pale patch on vertex ; tail dark (Sumatra &c.)

a^2. Size larger (Hindfoot = 78 ; Skull = 68) (Sumatra)...(16) *palliata*, Mill. (s.s.)

b^2. Size smaller (Hindfoot = 70 ; Skull = 68) (Banjak Islands, West Coast of Sumatra) .... (17) *p. lænata*, Mill.

B.—Shoulders, loins and legs not darker than rest of body ; pale colour of inner side of forelimbs not extending over front side of forearms.

a. Colour of belly white (Singapore; Johor) .... (18) *affinis*, Raffles. (s.s.)

b. Colour of belly yellow.

a^1. Feet yellow (Malacca) ...... (19) *a. auriventer*, Is. Geoff.

b^1. Feet dark (Selangore ; northwards to Lower Siam........... (20) *a. pyrsonota*, Mill.

1. *Ratufa macroura*, Penn.

1769. *Sciurus macrourus*, Pennant. Ind. Zool. I., pl. 1.

1785. *Sciurus ceilonensis*, Boddaert. Elench. An. p. 117.

Colour.—Above uniform black, below 'ochraceous buff.' Head ochraceous buff except for the forehead, above the level of the eyes, and a mark, shaped like an inverted '**V**' on the cheek, between eye and ear, black. A pale patch on the vertex between the ears. Forearms and hindlegs, below the upper thigh, buff. Hands and feet black. Tail black.

Skull.—Small. Nasals showing a slight expansion posteriorly in the skull I have seen.

Dimensions—Head and body, 300; tail, 340; hindfoot, 75. *Skull.*—Greatest length, 67; basilar length, 50; zygomatic breadth, 40; nasals, 20; diastema, 14·4; braincase breadth, 28·3; interorbital breadth, 25·5; upper molar series, 13·2.

Synonymy.—There has been much confusion in the naming of this species. Pennant, however, gave a figure of his *S. macrourus* which admits of no doubt. It is a uniformly black animal with a yellow belly and yellow fore and hindlegs, with black feet.—Boddaert's *ceilonensis* was confessedly a renaming of *macrourus.*

All naturalists since then seem to have ignored this black form altogether, and given the name *macrourus* to one of the other forms and even to the continental *R. indica maxima.* Blanford has, in his 'Mammalia,' actually transposed the names *macroura* and *tennenti.*

Distribution.—Owing to this difficulty of exactly appreciating of which particular form any given naturalist is treating, I have found it impossible to localise the habitat of this form. Blanford declares it to be a hill form, but I think this will prove to be a mistake and typical *R. macroura* will be found to inhabit low-lying forests. Any information which members can record on this point will be valuable.

2. *Ratufa macroura ceylonica*, Erxl.

1777. *Sciurus vulgaris ceylonicus*, Erxleben. Syst. Regn. An. p. 416.

Colour.—Pattern exactly as in true *macroura*, but a dark 'bay' everywhere substituted for the black in that form. Tail often with white tipped hairs especially in distal $\frac{2}{3}$.

Skull.—As in true *macroura.*

Dimensions.—Probably as in true *macroura*, judging from the specimens.

Distribution.—This form is represented in the National Collection by two specimens received with the East India Company's Collection. As already pointed out by Anderson (Zool. West. Yunnan p. 227); these specimens though labelled Java are quite different from anything known to occur in that island; and I may add are certainly indicated as coming from Ceylon by their yellow lower limbs, a character found nowhere else. In what part of Ceylon this race is found I cannot say nor even whether it extends to the mainland; this last I should very much doubt. This form is stated to be a seasonal form by Kelaart and others, but basing on the analogy of similar differences in other species I prefer to accept it provisionally as being a local race until more definite proof to the contrary is forthcoming.

3. *Ratufa macroura tennenti,* Blyth.

1849. *Sciurus tennentii.* Blyth, J. A. S. B. B., XVIII., p. 600.

Colour.—Pattern as in true *macroura* and *ceylonica*, but the 'bay' of the latter so profusely grizzled with white (each hair being tipped with white) as to be detected only by close examination. Buff of the fore arms and hindlegs extending more on to the feet than in either of the other two forms, so that only the toes remain black. Tail strongly grizzled with white from its very base, in its distal half obscurely, transversely barred black (or dark brown) and white, the bars each about 6-7 mm. wide.

Skull.—Slightly larger and stouter than in the other races.

Dimensions.—External dimensions possibly slightly larger than in *macroura*, though the hindfoot measurement does not materially differ from that of the other races.

Synonymy.—The name as spelt by Blanford (tennantü) is not authorized. The name as first published by Blyth was "*teanentii.*" This was obviously a misprint and 2 years later Blyth himself mentioned it again as *tennentii.*

Distribution.—This is, I think, undoubtedly the high level form (Kandy or higher). Jerdon quotes with some doubt instances of a pale form or faded specimens of this race having been taken in Mysore and on the Nilgiris and claims himself to have received it from Malabar.

There is a flat skin in the National Collection collected by Mr. W. M. Daly in the Shevroy Hills. It seems possible, therefore, that it occurs in the Peninsula, but whether it is found on the same ground as *R. maxima* or not remains to be shown.

4. *Ratufa dealbata*, Blanf.

1897. *Sciurus indicus dealbatus*, Blanford, Journ. B.N.H.S., XI., p. 301.

Colour.—General colour of the back 'cream buff' darkening to 'ochraceous buff' posteriorly, the individual hairs 'drab' for half their length basally, narrow paler line along middle of back; of under surface a buffy white. Ears clothed with long tawny ochraceous hairs forming a tuft. Face, forearms, hands and feet buffy white. Proximal ¼ of tail coloured like lower back, but the distal pale portions of hairs being proportionately shorter, looking darker, remainder of tail white, individual hairs white to their bases.

Skull.—Short and broad, as compared with *indica*; Nasals scarcely narrowed posteriorly.

Dimensions.—Head and body, 370; tail, 417; hindfoot, 77; skull: greatest length, 72: basilar length, 55; zygomatic breadth, 47; nasals, 24·5; diastema, 15; braincase breadth, 31; interorbital breadth, 30·5; upper molar series, 14·8.

Synonymy.—Blanford described this animal doubtfully as a subspecies of *indica*, to which it is undoubtedly very closely allied. In view of its totally different colour and the difference in the shape of the nasals, a character which appears to be constant in the other races of *indica*, I have ranked this as a distinct species.

Distribution.—I first found this animal in the Forests at the North extremity of the Surat Dangs. Its range was apparently very limited, extending over little more than 100 square miles. A friend, who has later visited the locality, tells me the race is now extinct, the last individual having been killed and eaten in the famine of 1900.

5. *Ratufa indica*, Erxl.

1777. *Sciurus indicus*, Erxleben, Syst. Regn. An. p. 420.

1777. *Sciurus purpureus*, Zimmermann, Spec. Zool. Geog. Quad. p. 518.

1785. *Sciurus bombayanus*, Boddaert, Elench. An. p. 117.

1831. *Sciurus elphinstonii*, Sykes, P. Z. S. p. 103.

Colour.—General colour of upper side bright 'hazel,' basal half of individual hairs drab, a narrow paler line along middle of back, obsolescent but recognizable; of the under surface 'cream buff'. Face brownish white, approaching 'clay colour', a white patch on crown, between the ears. Ears covered with long hairs rather darker than the back, forming a tuft. Tail basally coloured like back, fading through ochraceous white to pure white, in last third of its length. Hands and feet coloured like face, forearms rather paler.

In a common variety 'bay takes the place of 'hazel' in the general colour and the pale colouring on the tail is usually limited to an orange-white tag at the extreme point.

Skull.—Large and stout.—The nasals narrowing posteriorly for $\frac{2}{3}$ their length and then widening again.

Dimensions.—Head and body, 400; tail, 425; hindfoot, 78. The first two measurements are those given by Erxleben and are probably fairly correct. Skull: greatest length, 71; basilar length, 56; zygomatic breadth, 4·45; nasals, 2·23; diastema, 15·6; braincase breadth, 32; interorbital breadth, 28; upper molar series, 14·5.

Synonymy.—Erxleben's preface to his Syst. Regn. An. is dated 1776. So as a choice has to be made between his and Zimmermann's names, I have followed Blanford in adopting *indica* as the older. Both authors, as well as Boddaert, quote Pennant's 'Bombay Squirrel'. Sykes based his *elphinstonii* on three specimens now in the national collection, two of which were the 'hazel' and one the 'bay' variety.

Distribution.—This race is found throughout the Ghats in the Bombay Presidency. I have seen the 'hazel' variety often North of Poona, but never the 'bay'. It is possible that more material will show that the two varieties do not occur together, but are as well marked geographical races as any of the others, in which case the name of *elphinstonii* will be available, for the 'hazel' form by limitation, all the other names having undoubtedly been based on the 'bay' animal.

6. *Ratufa indica bengalensis*, Blanf.

1897. *Sciurus indicus bengalensis*, Blanford, Jour. B. N. H. S., XI., p. 303.

Colour.—General colour as in the dark variety of true *indica*, but the tail, instead of being concolorous with the back, is black throughout, except for a pale tip.

Skull.—Quite as in true *indica.*

Dimensions.—As in true *indica.*

Distribution.—*Ratufa indica* seems to be peculiarly sensitive to the action of environment. Almost each Forest seems to harbour its own variety, but, in any locality, the prevailing variety seems to be extraordinarily constant in its characters. Blanford gives as the distribution of the present race " Western Bengal, Orissa, Chutia Nagpur, and the Northern Circars, * * * , Jaipur and the neighbourhood of the Godaveri." A couple of specimens sent by Mr. Caccia, I. F. S., from Hoshangabad certainly are more like Mysore specimens than *bengalensis.* I would venture to prophesy that when sufficient material is available the habitat of *bengalensis* will be found to coincide closely with the South side of the Ganges Basin ; that a new name will have to be found for the race inhabiting the central portion of India.

7. *Ratufa indica maxima*, Schreb.

1784. *Sciurus maximus*, Schreber. Saugth. IV. p. 784, pl. ccxvii, B.

1786. *Sciurus malabaricus*, Scopoli, Del. Faun. Flor. Ins. II., p. 85.

Colour.—Colour (including that of tail) as in *bengalensis*, but the shoulders, rump and thighs, black (in some specimens ; the black of the shoulders and rump joined by a medial black line, so that, in extreme cases, only the flanks remain ' bay ').

Skull.—As in *indica*, in all essential characters, slightly larger in size.

Dimensions.—Rather larger than *indica.* Hindfoot, 80. Skull : greatest length, 77; basilar length, 60; zygomatic breadth, 49 ; nasals, 24 ; diastema, 16.5 ; braincase breadth, 33 ; interorbital breadth, 30 ; upper molar series, 15.

Synonymy.—Blanford adopts (B. N. H. S. Jour. 1897, p. 302), the later name *malabarica* which of course is inadmissible.

Distribution.—The main habitat of this race is the Malabar Coast. How far it extends southwards towards Cape Comorin remains to be decided. It is stated that in the extreme south of the Peninsula the giant squirrels are represented by *R. macroura tennentii*, but whether any race of *indica* is also present is not known. For the present, Mysore must be included within the range of *malabarica,* but the form found there seems to differ quite as much from typical *malabarica* as it does from typical *bengalensis.* When more material is available, it will probably (joined with the form of the Godavery Valley), be separated as a quite constant geographical race.

8. *Ratufa gigantea,* McCl.

1839. *Sciurus giganteus,* McClelland (Horsfield), P. Z. S. p. 150.

Colour.—Above, entirely black, individual hairs paling to 'burnt umber' at their bases; below, buff, individual hairs of the abdomen however, black for their basal halves, giving a soiled appearance to this part. Face coloured like back, cheeks upwards to a line drawn from the ear to the nose through the eye like the belly, except for a dark horizontal streak below the eye. Two small black spots below the chin.

Skull.—Longer than in *macruroides.*

Dimensions.—Head and body, 417 ; tail, 477 ; hindfoot, 87. Skull : greatest length, 80 ; basilar length, 62 ; zygomatic breadth, 49 ; nasals, 26 ; diastema, 17.6 ; braincase breadth, 35.5 ; interorbital breadth, 31 ; upper molar series, 15.

Distribution.—The species was described "from seven or eight specimens" taken in Assam. The Natural History Museum has no specimen from that locality, but 2 skins from the N. Burma frontier and one from N. Siam show no variation and accord well with McClelland's description.

9. *Ratufa macruroides,* Hodgs.

1849. *Sciurus macruroides,* Hodgson, J. A. S. B. XVIII., p. 775.

Colour.—General pattern exactly as in *gigantea.* Above, burnt umber ; below 'ochraceous buff.' Hands, feet and tail rather darker than back.

Skull.—Rather smaller than in *gigantea.*

Dimensions.—As in *gigantea* proportionately shorter, about equal in length to head and body. Skull : greatest length 77 ; basilar length, 61 ; zygomatic breadth, 47.5 ; nasals, 24 ; diastema, 17 ; braincase breadth, 34 ; interorbital breadth, 33 ; upper molar series, 14·8.

Synonymy.—The name *macruroides* was published first by Hodgson in 1844 (Calc. Journ. N. H. IV, p. 293), and thereafter two or three times, without any description. In 1849, however, in a paper on the Geography, &c., of Nepaul, he mentioned it in connection with what may be technically accepted as a description. That the present animal is the one referred to by Hodgson is proved by the series of specimens in the National Collection presented by him. No other *Ratufa* is known from Nepal.

Distribution.—Besides Hodgson's Nepal specimens there is a specimen in the collection from Sikhim. From Assam eastwards it is replaced by *gigantea.*

10. *Ratufa melanopepla*, Mill.

1900. *Ratufa melanopepla*, Miller, Prac. Wash. Ac. Sc. II. p. 71.

Colour.—Above, glossy black, basal half of individual hairs dark reddish brown ; below 'ochraceous', bases of hairs blackish brown. Face black ; cheeks pale yellow ('cream buff'), a black horizontal streak behind whiskers and a black spot under the chin. Inner sides of arms and legs buff, this pale colour spreading over outer side of forearm. Hands, feet and tail black.

Skull.—As in *gigantea* but smaller ; bullœ narrower.

Dimensions.—Head and body, 360 ; tail, 430 ; hindfoot, 75. Skull : greatest length, 70 ; basilar length, 53 ; zygomatic breadth, 44 ; nasals, 22 ; diastema, 15 ; braincase breadth, 31 ; interorbital breadth, 28·5 ; upper molar series, 14.

Distribution.—The type locality is Trong, Lower Siam. The Museum Collection contains specimens from Camboja, Lower Siam, Tenasserim, Selanga Island and the Malay Peninsula as far south as Selangore.

11. *Ratufa melanopepla anambœ*, Mill.

1900. *Ratufa anambœ*, Miller, Proc. Wash. Ac. Sc. II., p. 215.

I have seen no individual of this species and extract the following details from Miller's original description. It is characterised especially by its large size.

Colour.—" Cheeks, throat, sides of neck, inner surface of legs and entire ventral surface of body rich tawny yellow (ochraceous), paler on throat, cheeks and sides of neck, richer on chest, the belly much darkened by appearance at surface of blackish bases of hairs. Remainder of pelage and entire tail glossy blue black, with the usual reddish brown cast below the surface."

Skull.—As in *melanopepla.* "bullœ narrower and more elevated above surface of basi-occipital."

Dimensions.—Head and body 374 ; tail 451 ; hindfoot 76. Skull: greatest length, 72 ; basilar length, 56 ; zygomatic breadth, 45; nasals, 25 ; interorbital breadth, 26 ; upper molar series, 14.

Synonymy.—As an island form Mr. Miller ranked this as a distinct species, but in my opinion it is in every way more convenient to treat it as a geographical race of the very similar *melanopepla.*

Distribution.—Anambas Islands, South China Sea.

12. *Ratufa melanopepla angusticeps*, Mill.

1901. *Ratufa angusticeps*, Miller. Proc. Wash. Ac. Sc. III, p. 130.

The type specimen, the only one known, is in the Washington Museum. I borrow the following details from Miller's original description.

Colour.—"Precisely like that of *Ratufa anambœ* and *R. melanopepla.*"

Skull.—"Immediately recognisable by its general narrowness, but particularly in the region of the anterior zygomatic roots. Audital bullœ narrower and more elongate than in *R. melanopepla* and more elevated above the basi-occipital. Lateral processes of basi-occipital obsolete."

Dimensions.—Head and body, 342 ; tail, 406 ; hindfoot, 74. Skull : greatest length, 68·6 ; basilar length, 52 ; zygomatic breadth, 41 ; nasals, 22 ; diastema, 15·6 ; interorbital breadth, 27 ; upper molar series, 14.

Synonymy.—I prefer to treat this form as a sub-species of *melanopepla.*

Distribution.—Lingung Island, Natuna Archipelago. The only individual yet found so far South.

13. *Ratufa melanopepla fretensis*, Thos. & Wrough.

1909. *Ratufa melanopepla fretensis*, Thomas and Wroughton, A. M. N. H. p. 535.

Colour.—As in *melanopepla*, but the pale portions markedly darker than in that form. The abdomen and chest are 'tawny' or even darker and fade at most to 'ochraceous buff' on the cheeks and forelimb.

Skull.—As in *melanopepla.*

Dimensions.—Head and body, 370 ; tail, 430 ; hindfoot, 76. Skull: greatest length 72 5 ; basilar length, 55 ; zygomatic breadth, 46 ; nasals, 22 ; diastema, 16·4 ; braincase breadth, 32 ; interorbital breadth, 27 ; upper molar series, 13·1.

Distribution.—The type locality is Lungkawi Island, but it is also found in Terutau and Penang Islands in the Straits of Malacca.

14. *Ratufa melanopepla tiomanensis*, Mill.

1900. *Ratufa tiomanensis*, Miller, Proc. Wash. Ac. Sc., II., p. 216.

Colour.—As in *fratensis*, but even darker.

Skull.—As in *melanopepla.*

Dimensions.—Head and body, 350 ; tail, 380 ; hindfoot 72.

Distribution.—Tioman Island on the East Coast of the Malay Peninsula.

15. *Ratufa bicolor*, Sparrm.

1778. *Sciurus bicolor*, Sparrman, Gotheb. Vet. Svensk. Handl. I., p. 70.

1780. *Sciurus javensis*, Zimmermann, Geog. Gesch. II., p. 342.

1817. *Sciurus albiceps*, Desmarest, Nouv. Dict. H. N. X., p. 105.

1820. *Sciurus leschenaultii*, Desmarest, Mamm., p. 335.

1835. *Sciurus humeralis*, Coulon, Mem. Soc. S. N. Neufch. I., p. 122.

Colour.—General colour of back very dark 'bay' (almost black), bases of individual hairs black, paling to brown at tip of belly, chest and throat and inside of thighs, and front of forearm, 'ochraceous buff', individual hairs with basal $\frac{2}{3}$ black. Face coloured like back but paling markedly above the level of the eyes ; cheeks dull white. Dark spot under the chin. Sides of neck and inside of forelegs bright 'buff', the hairs unicoloured to their bases. Shoulders and outside of upper arms black. Loins, thighs and basal portion of tail (100 mm.) black, but the hairs coarsely tipped with white (grizzling usually less, often absent, immediately at the base of the tail). Feet and hands black, some grizzling on the former. Tail (beyond the basal dark portion) bright 'buff'.

Skull.—As in *melanopepla*, but slightly larger.

Dimensions.—Head and body, 360; tail, 400; hindfoot, 75. Skull: greatest length, 72; basilar length, 56; zygomatic breadth, 45; nasals, 21; diastema, 17; braincase breadth, 31; interorbital breadth, 28; upper molar series, 14.

Synonymy.—The names *bicolor*, and *javensis* refer undoubtedly to typical *bicolor*. Desmarest no doubt had before him in 1817 an abnormal individual with the normal paling of colour on the forehead and vertex carried to extremes (such examples are probably not rare; there is in the Museum Collection a Siamese specimen of *melanopepla* which has an almost white head, although normally in that species no paling of colour on the crown is to be found). To some such specimen he gave the name *albiceps*. Two years later however, having received normal specimens of *bicolor*, he described and named *leschenaultii* from them. *Sciurus humeralis* of Coulon, as shown by both description and figure, is typical *bicolor*.

Distribution.—Island of Java.

16. *Ratufa palliata*, Mill.

1902. *Ratufa palliata*, Miller, Proc. Ac. N. S. Phil., p. 147.

Colour.—General pattern as in *bicolor*, but pale area on vertex, grizzling on loins and thighs absent, yellow on tail obsolescent. Colour of back near 'russet' when fresh, rapidly fading: lower surface dirty yellowish, individual hairs brown with yellow tips. Face, neck, arms and thighs dark brown, almost black. Cheeks, sides of neck and inside of forelegs pale yellow. Throat and inner side of hindlegs like belly, usual dark spots under chin. Tail coloured like back but the hairs tipped whitish (showing when tail is flattened a pale edging along its whole length.)

Skull.—As in *bicolor*, but anterior portion shorter; teeth rather smaller.

Dimensions.—Head and body 345; tail 425; hindfoot 78. Skull: greatest length, 68; basilar length, 53; zygomatic breadth, 42 nasals, 21; diastema, 16; braincase breadth, 33; interorbital breadth, 29; upper molar series, 12·8.

Distribution.—Type locality Indragiri River. It seems to range along the whole East Coast of Sumatra.

17. *Ratufa palliata lœnata*, Mill.

1903. *Ratufa lœnata*, Miller, Proc. U. S. Nat. Mus. XXVI., p. 720.

Colour.—Quite as in *palliata*, but the white tips of the hairs of the tail rather longer, and therefore the white lateral edges of the spread out tail more marked.

Skull.—Skull in size and form as in *palliata* : the premaxillaries extending farther behind posterior edge of nasals, palate narrower relatively to its length than in typical *palliata*.

Dimensions.—Head and body, 330 ; tail, 400 ; hindfoot 68. Skull ; greatest length, 68 ; basilar length, 52 ; zygomatic breadth, 41 ; nasals, 22 ; interorbital breadth, 27 ; upper molar series, 13.

Synonymy.—As an island form Miller ranks it as a species.

Distribution.—Banjak and Batu Islands, West Coast of Sumatra.

18. *Ratufa affinis*, Raff.

1822. *Sciurus affinis*, Raffles, Trans. Linn. Soc. XIII., p. 259.

Colour.—General colour above drab, individual hairs very shortly tipped black, giving a minutely grizzled effect in certain lights, dorsal colour becoming more and more ochraceous towards the flanks, till a stripe about 15 mm. broad is pure 'tawny ochraceous'. Colour of lower surface pure white. Tawny ochraceous of flanks extending on to the forearms and hind legs. White of belly extending upward on the thighs. Tail coloured like the back above, white (medially at least) below. Hands and feet white.

Skull.—Skull small, but in form normal ; nasals contracting posteriorly to about two-thirds their length, then expanding to posterior margin. In this character resembling *indica*, etc., and differing from *melanopepla*, etc.

Dimensions.—Head and body, 330 ; tail, 380 ; hindfoot, 70. Skull ; greatest length, 67 ; basilar length, 51 ; zygomatic breadth, 40 ; nasals, 21 ; diastema, 15 ; braincase breadth, 31 ; interorbital breadth, 27 ; upper molar series, 13·5.

Habitat.—Singapore Island, extending northwards on main land to Johor.

19. *Ratufa affinis auriventer*, Is. Geoff.

1831. *Sciurus auriventer*, Is. Geoffroi, Voy. Bel. Indes, p. 151.

Colour.—General colour above as in *affinis* ; below tawny ochraceous of flanks, extending downwards and replacing white of *affinis*. Thigh patch buffy white. Tail coloured above like the back ; below, at least medially, white. Hands and feet coloured like the belly.

Skull.—As in *affinis*.

Dimensions—As in *affinis*.

Synonymy.—The name *auriventer* was based on a specimen said to have been brought from Java by M. Diard, who also collected in the Peninsula. In other cases it has been found that there has been confusion in assigning the true locality to specimens collected by him. Nothing resembling the description of *auriventer* has been found in Java, while on the other hand it very well fits the present form, and I follow Bonhote (A. M. N. H. 1900, p. 495), therefore in accepting the name for this form.

Habitat.—All the specimens in the National Collection are labelled "Malacca," and, as the next form is found in Selangore and thence northwards as far as Trong in Lower Siam, this must mean the Island of Malacca.

20. *Ratufa affinis pyrsonota*, Mill.

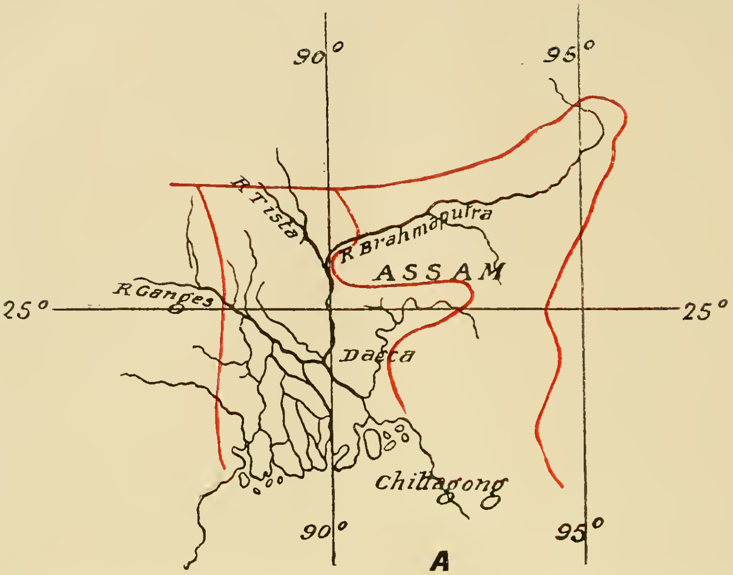
1900. *Ratufa pyrsonota*, Miller, Proc. Wash. Ac. Sc. II., p. 75.

Colour.—General colour above grizzled ochraceous, individual hairs slate grey at base ; below clear ochraceous. This is in fact a very ochraceous coloured form of *affinis*, with very dark brown feet.

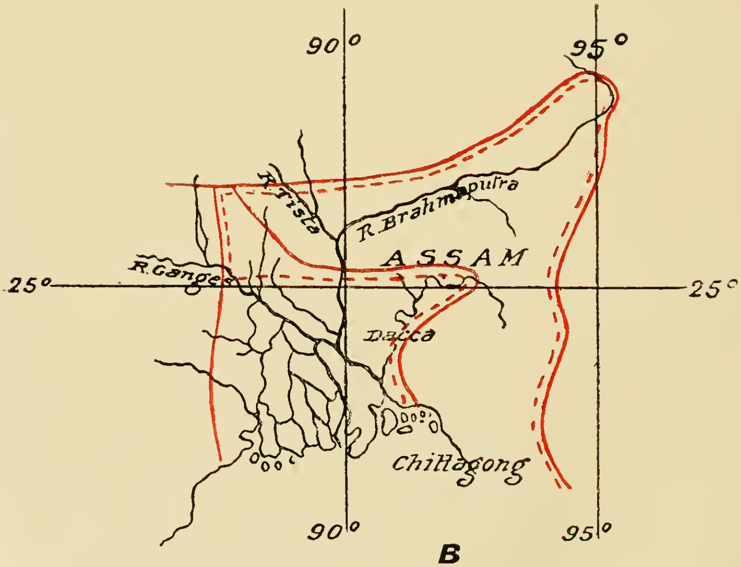
Skull.—As in *affinis*, but larger.

Dimensions.—Head and body, 350 ; tail, 400 ; hindfoot 75. Skull : greatest length, 65 ; basilar length, 51 ; zygomatic breadth, 41 ; nasals, 21 ; diastema, 16 ; braincase breadth, 32 ; interorbital breadth, 26 ; upper molar series, 13.

Distribution.—The type locality is Trong in Lower Siam, but it extends as far South as Selangore.


90°
95°
R Tista
R Brahmaputra
ASSAM
R Ganges
25°
25°
Dacca
Chittagong
90°
95°
A

(*A*) Boundaries of the Bengal and Assam Tracts as shown by Blanford (Phil. Trans., Royal Soc., Lond., Series B, Vol. 194, 1901).


90°
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ASSAM
R Ganges
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25°
Dacca
Chittagong
90°
95°
B

(*B*) Modification of the boundary between the Bengal and Assam Tracts as suggested by this paper.

NOTES ON SNAKES COLLECTED IN THE JALPAIGURI DISTRICT.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

(*With a Map.*)

Last year I received a collection of snakes from Mr. W. A. Jacob, I.F.S., made by himself in the Jalpaiguri District.

With two exceptions, *viz.*, one *Dipsadomorphus cynodon*, which was caught west of the Tista River, and the *Naia bungarus*, which was killed in the Buxa Division (2,000 ft. elevation), about 100 miles east of the Tista, all were collected between 10 to 50 miles east of the Tista, at altitudes varying from about 500 to 1,200 feet.

From this collection it would appear that the boundary between the Bengal and Assam Tracts, north of the 25th parallel is placed too far to the east by Blanford (see figure A). There can be little doubt that this boundary should be the Tista River or still further west (see figure B). It even seems probable that all the territory lying above the 25th parallel east of Purneah should be included in the Assam Tract (see interrupted red line in figure B). In support of this are the following records. From the east *Typhlops diardi* and *Simotes cyclurus* have been found as far west as Purneah. *Simotes albocinctus* as far west as Kaliganj.

Of Indian snakes *Polyodontophis sagittarius* is recorded as far east as Darbangha, *Simotes arnensis* to Kaliganj, *Zamenis fasciolatus* to Monghyr, *Dipsadomorphus forsteni* and *Bungarus cœruleus* to Purneah. All of these records are based on specimens in the Indian Museum.

TYPHLOPIDÆ.

Typhlops diardi.

One adult specimen. The scale rows are 26 anteriorly and in midbody, and 24 at a point two headslengths before the anus. The reduction of rows is singular and due to a fusion of the 2nd and 3rd rows and the 5th and 6th rows both on the right side of the median ventral.

COLUBRIDÆ.

Tropidonotus stolatus.

Seven examples.

Tropidonotus piscator.

One specimen of variety *quincunciatus.*

Pseudoxenodon macrops.

A single specimen.

Lycodon aulicus.

One specimen of variety D of Boulenger's Catalogue. The ventrals and subcaudals 211 + 67. Anal divided.

Coluber cantoris.

A single example. The costals are in 21 rows, two headslengths behind the head and in midbody, 17 at a point two headslengths before the anus. Ventrals and subcaudals 229 + 69. The 3rd supralabial is not divided, and the 4th and 5th only touch the eye.

*Dendrophis proarchos** (Wall).

2 examples. The costals are in 15 rows anteriorly and in midbody, 9 at a point two headslengths before the anus. The ventrals and subcaudals 182 + 142 and 192 + ?, the latter a ♀. The anal is entire in both specimens and both entirely agree with the many Assam specimens I have seen of this snake. The vertebral are broader than long. The supralabials are 9, the 4th, 5th and 6th touching the eye. The ♀ contained 7 eggs but the date of capture is unfortunately not on record.

Simotes albocinctus.

One variety *typica* (Cantor), and two of a variety calling for special remark. It is most like *juglandifer* (Wall) (variety C of Boulenger's Catalogue), but differs in that there are no black walnut-shaped spots. A darker broad stripe 5 rows wide, runs down the middle of the back, and a narrower dark stripe between the 3rd and 4th rows above the ventrals and there are no crossbars. I suggest the name *dorsolateralis* for it. It is probably only a modified form of *juglandifer* for a suggestion of the walnut marks is sometimes noticeable here and there if looked for beneath a lens. The costals are in 19 rows, anteriorly and in midbody, and 15 at a point two headslengths before the anus. The ventrals and subcaudals are var. *typica* 191 + ?, and in the others 170 + 30, and 162 + 39. The supralabials in variety *typica* are 8, the 4th and 5th touching the eye on the right side, normal on the left. In both specimens of variety *dorsolateralis* the 3rd supralabial is divided into an upper and a lower part. (Hence the subocular of Boulenger). In one of these the lower fragment is not completely excluded from contact with the eye.

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* A description of this snake appears in a paper on the Snakes of Assam in this Number, page 827.

Dryophis prasinus.

Two examples. The costals are in 15 rows anteriorly, and in midbody and in the ♂ come to 11 at a point two headslengths before the anus. In the ♀ they reduce to 9 at the same site. The ventrals and subcaudals of the ♂ are 198+157? and of the ♀ 201+159. There are two loreals in the ♂ 1+1, three in the ♀ 1+1+1. In the ♂ the 4th supralabial is not divided, but in the ♀ it is so, that the upper part only touches the eye.

Chrysopelea ornata.

One brilliantly coloured example of variety E of Boulenger's Catalogue (III, p. 198). The costals are in 17 rows anteriorly and midbody, and 13 at a point two headslengths before the anus. The ventrals and subcaudals are 215×112·? (tail slightly docked). The last ventral as well as the anal is divided.

Dipsadomorphus cynodon.

Two fine examples of variety A of Boulenger's Catalogue (III., p. 79.). The costals are in 23 rows anteriorly, and in midbody, 15 at a point two headslengths before the anus. The ventrals and subcaudals are 255+ 126 and 256 + 123. One of these specimens was being attacked by a banded krait (*Bungarus fasciatus*) which Mr. Jacob shot.

Bungarus lividus.

One small example. The vertebrals are very slightly enlarged. The ventrals and subcaudals are 212+39.

Naia bungarus.

One young specimen, about 6 feet in length. The costals are 17 at a point two headslengths behind the head, 15 in midbody and 15 at a point two headslengths before the anus. The ventrals and subcaudals are 251+80, of the latter the first to the fifth are entire, the rest divided. It is black with narrow buff bands posteriorly. Mr. Jacob tells me that a pair of hamadryads were reported to have been killed "in copula" on a tea garden close to him at the end of April or early in May last year.

VIPERIDÆ.

Lachesis gramineus.

A single specimen. The costal rows are 21 in the anterior and middle parts of the body, 15 at a point two headslengths before the anus. The ventrals and subcaudals 171+57. It is greenish-yellow in colour with a whitish flank line. It had evidently eaten some mammal for a mass of felt-like matted hair was protruding from the anus.

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NOTES ON THE BIRDS OF CHITRAL.

(*October* 1902 *to October* 1903.)

BY

CAPT. G. A. PERREAU, F.Z.S. (4TH GURKHAS).

It is not necessary for me to go into details about the country, as Capt. H. Fulton has already done that in his notes, see Vol. XVI, p. 44, of this Journal. My area was small, being practically only the ground about Drosh, the main valley between Nagar and Chitral, and the valley between Nagar and Ziarat. I certainly had one productive but rapid trip up the Mastuj Valley, nearly as far as the Shandur Lake, but most of my birds were got at under 7,000 ft. I commenced operations soon after arrival, earlier, I fancy, than Capt. Fulton did; but, on the other hand circumstances prevented me from doing as much as I should have liked after August. My best thanks are due to Capt. Fulton for allowing me to copy his rough notes before he left Chitral; they were most useful.

I follow the numbers and nomenclature in "The Fauna of British India—Birds". Except where otherwise mentioned identification was made from skins. Those which come under Vol. II, (with a few at the end of Vol. I, put in to fill up a box), slightly under two hundred, were sent to the Society. The remainder were retained by me for the purpose of substituting proper labels for my rough ones, which were of no use without my notes. These skins (over 250) were destroyed by mice, a warning to send off things quickly. However the only doubtful ones were amongst the lot sent. My best thanks are due to Mr. E. Comber for checking them at the British Museum (Natural History), and to Mr. N. B. Kinnear for kindly clearing up some doubtful points by looking up specimens in the Society's collection.

I am sure Capt. Fulton will not mind my quoting his records in cases where I have not observed the bird myself. It makes it much easier for future observers to have all records together. In spite of Mr. Comber's opinion, I think that the list from Chitral is still very incomplete. See also Vol. XVI., p. 744 and Vol. XVIII., p. 186 for additions to Capt. Fulton's above-mentioned notes. Species marked with an asterisk are not recorded by Capt. Fulton, who recorded none of which he did not make a skin.

FAMILY—CORVIDÆ.

(4) *Corvus macrorhynchus*—(THE JUNGLE CROW.)

Common all the year round near Drosh. There was a pied one generally about the Fort; some breed close, some appear to go higher.

* (5) *Corvus frugilegus.*—(THE ROOK.)

Arrived in flocks on Lower Drosh farm about mid-March and went off at the end of April.

(9) *Corvus monedula*—(THE JACKDAW.)

Small parties arrived and departed with the rooks. I have no doubt that more careful observation (or perhaps more shooting) would add to the list of "crows."

(10) *Pica rustica*—(THE MAGPIE.)

Fairly common in December as low down in the main valley as Ghaira under 4.500 feet. Saw numbers courting in the Mastuj valley in May.

(24) *Garrulus lanceolatus*—(THE BLACK-THROATED JAY.)

Very common all the year round; down to 4,000 feet in winter. Chitralis often hawk it with a sparrow-hawk, with little success as a rule; it is hard to drive out of cover.

(28) *Nucifraga multipunctata*—(THE LARGER SPOTTED NUT-CRACKER.)

No skin obtained; one was sent in to me from Utzen about 7,500 feet, the condition allowed easy identification, but the skin was a bad failure. I saw two in June in the Drosh nullah at about the same height. Fulton records it from Pattison.

* (29) *Graculus eremita*—(THE RED-BILLED CHOUGH.)

Common along the main valley at about 5,000 feet from November till March. I saw them at no other time.

(30) *Pyrrhocorax alpinus*—(THE YELLOW-BILLED CHOUGH.)

Like the last but coming down lower and staying later. Villagers at Ayon offered to take me to a nesting place, stating that it was a good way off and up, and that the nests were nearly inaccessible. Nearly inaccessible for a Chitrali means a great deal and anyhow I could not go just then. One of my skins had black legs with yellow not red, showing through the joints, not sexed.

SUBFAMILY—PARINÆ.

The Tits are very fairly represented, but I think the list can be added to. The first time I tried the "Sanatorium" above Drosh, about 6,000 ft., I saw lots of Red-headed Tits (or a near relation), it was early in December; having got enough to keep us busy I left them till later. I did not see them again though I tried for them several times. I do like watching a hunting party of tits on their rounds, at least two or three sorts in goodly numbers accompanied by Goldcrests, Tree-creepers, Nuthatches, and a few Woodpeckers.

They are all so busy and tame and there is such a pleasant twittering going on all the time.

(3) *Parus atriceps* (THE INDIAN GREY TIT.)

I found this bird fairly common all the year round near Drosh, 4,500 ft. and two pairs nested in holes in walls in the Commissariat lines in Lower Drosh.

(37) *Ægithaliscus leucogenys*—(THE WHITE CHEEKED TIT.)

I never obtained this bird, though I may have seen it. Fulton records it as common in the lower valley.

(46) *Lophophanes melanolophus*—(THE CRESTED BLACK TIT).

Very common from 5,000 feet up in the cedars.

(47) *Lophophanes rufinuchalis*—(THE SIMLA BLACK TIT.)

Same as the last. They are generally found together.

(N. S) *Cyanistes tianschanicus*—(CHINESE BLUE TIT.)

This is an entirely new species discovered by Capt. Fulton. I did not meet it. He only found it at Shost 10,000 ft) where there were numbers in the dense scrub in the river bed in July. He describes it as being like the European Blue Tit but less bright.

FAMILY—CRATEROPODIDÆ.

As might be expected, this family is poorly represented, but the list would probably be increased a little by beating in the undergrowth in the lower part of the valley.

(91) *Trochalopterum simile*—(THE WESTERN VARIEGATED LAUGHING-THRUSH.)

I only got one at Nagar in November. There were probably lots about which would have been found with beating. Fulton records them as common.

(99) *Trochalopterum lineatum*—(THE HIMALAYAN STREAKED LAUGHING-THRUSH.)

Very common up to about 6,000 feet. Like others of their family they go about in little parties, but they differ in their method of getting from tree to tree or more often from bush to bush. Babblers and other Laughing-Thrushes work up a tree to the top and then "dribble" across to the next by sailing on open wings to the foot of it. *T. lineatum* work up to the top, do a perpendicular dead drop to the ground, and then rapidly "dribble" across to the next by doing a hurried "scuttle", half hop, half fly along the ground. They often scuttle back in apparent alarm, even when more than half way across the open, practice in jinking I suppose. Proficiency in jinking must mean a great deal to them as they usually inhabit a fairly open country abounding in hawks. But the forest dwelling birds do just the same. Chitralis only hawk them when there is absolutely nothing else to be raised ; it is nearly impossible to flush them once they have spotted the game. I know no bird harder to hold alive in the hand ; a novice has less chance of success than he has of successfully girthing up a hill pony. A small party makes a very interesting addition to an aviary, but the aviculturist with a weak heart is warned off, the oft-repeated impression that some bird has fallen off his perch in a fit is trying. Also catching them out with a butterfly net may be regarded as a very severe trial of temper and patience; they hide and jink in an almost impossible way. The "drop" is marvellous, it looks sheer straight, which it cannot be because of the branches. I fear this is rather an avicultural note, will try not to let it occur again.

Oates is of opinion that the subfamily *Crateropodidæ* "probably derive no portion of their food directly from trees," my observations do not agree with this.

(187) *Myiophoneus temmincki*—(THE HIMALAYAN WHISTLING-THRUSH.)

Common.

(269) *Hypsipetes psaroides*—(THE HIMALAYAN BLACK BULBUL.)

Common summer visitor arriving at the end of April.

*(283) *Molpastes intermedius*—(THE PUNJAB RED-VENTED BULBUL.)

No skin. Only one pair was seen, summer visitors; they nested on the Lower Drosh farm. Practically certain to have been this variety of Red-vented Bulbul.

(284) *Molpastes leucogenys*—(THE WHITE-CHEEKED BULBUL.)

A few present in the winter up to 4,500 feet; numbers greatly increased by summer visitors; only partial migrants, I fancy, arriving in March. They range only slightly higher in summer

FAMILY—SITTIDÆ.

(320) *Sitta kashmirensis*—(BROOKS'S NUTHATCH.)

No skin, but I identified from the dead bird. Saw some in December and again in May a little over 6,000 feet at the Sanatorium above Drosh among the tits. Not seen again. Fulton reports them as common towards Dir.

(323) *Sitta leucopsis*—(THE WHITE-CHEEKED NUTHATCH.)

Very common in winter down to 6,000 feet among the tits.

FAMILY—DICRURIDÆ.

(327) *Dicrurus ater*—(THE BLACK DRONGO.)

Very common summer visitor up to 5,500 feet. Arrives in mid-April.

FAMILY—CERTHIDÆ.

(341) *Certhia himalayana*—(THE HIMALAYAN TREE-CREEPER.)

Common in winter down to 6,000 feet, often seen among the tits. A few were seen in December as low as 4,500 feet and some were seen at 7,000 feet in June.

(348) *Tichodroma muraria*—(THE WALL-CREEPER.)

Common down to 4,000 feet in winter arriving in October, leaving in early May. One pair (apparently) hung about Drosh fort till early July. Eager, but vain search was made for the nest, I fancy they were weaklings resting, as they re-appeared without young in September.

*(352) *Anorthura neglecta*—(THE KASHMIR WREN.)

Common in winter about Drosh down to 4,000 feet, seemed to have left by

April. The owner of a Sparrow Hawk in want of something to do often hunts them. Beating the little beggar out (if possible) provides the chief excitement, the hawk being seldom wanted.

*(?).—A tailed wren.

In December about the Lower Drosh farm (about 4,200 feet I think) there were several wrens with long tails hanging about for some time. My two skinners were not at that time up to small birds, and I, thinking they would improve in this line sooner than they did (they never became really reliable with small birds), rather put off shooting small birds, which I thought I could get later. In January I awoke to the fact that these birds were probably a prize. I never saw them again.

FAMILY—REGULIDÆ.

*(358) *Regulus cristatus*—(The GOLDCREST.)

Very common in winter down to 6,000 feet in the cedar forests in parties with tits. A few were seen as low as Drosh Fort. It was also seen in June above Drosh at about 7,500 feet.

FAMILY—SYLVIIDÆ.

I confess to having shied off Warblers, I fancy Capt. Fulton did too. Thanks to Mr. Oates, the identification of a clean, fresh-killed adult specimen is not so formidable as it appears. I am sorry that I did not procure the ones that even I, a tyro in warblers, could discern, without shooting, as being different species. There were only a few such in the main valley, but I saw quite a dozen on my trip up the Mastuj Valley. I only took two skins, which I briefly mention below. I saw birds very like the English Blackcap, Nightingale and Sedge Warbler.

(401) *Sylvia althæa*—(HUME'S LESSER WHITE-THROATED WARBLER.)

*(408) *Phylloscopus indicus.*—(OLIVACEOUS WILLOW-WARBLER.)

Both from near Mastuj. In parts the river bed is covered with reeds and willow ; small undergrowth covers the banks, an ideal place for warblers.

(418) *Phylloscopus humii*—(HUME'S WILLOW-WARBLER.)

Not noted by me. Fulton obtained one in April at 10,000 feet and one in September at 6,000 feet.

FAMILY—LANIIDÆ.

(473) *Lanius vittatus*—(THE BAY-BACKED SHRIKE.)

Very common summer visitor, arriving the end of April up to 6,000 feet.

(476) *Lanius erythronotus*—(THE RUFOUS-BACKED SHRIKE.)

Very common summer visitor, arriving beginning of April up to 7,000 feet.

(477) *Lanius tephronotus*—(THE GREY-BACKED SHRIKE.)

I did not meet this bird. Fulton states that he got one specimen in April at Drosh, but is rather doubtful as to his identification being correct.

(495) *Pericrocotus brevirostris*—(THE SHORT-BILLED MINIVET.)

Very common summer visitor. First seen on 9th April at 4,000 feet in Main Valley · common for about a month after at about 4,500 feet ; then it went up to 6,000 feet except a few stray birds.

FAMILY—ORIOLIDÆ.

(518) *Oriolus kundoo*—(THE INDIAN ORIOLE.)

Very common summer visitor, arriving beginning of May up to about 5,000 feet, or perhaps higher as I met it at Reshan.

FAMILY—STURNIDÆ.

*(528) *Pastor roseus*—(THE ROSE-COLOURED STARLING.)

No skin.—It was abundant round Chitral Fort in January.

*(53) *Sturnus porphyronotus*—(THE CENTRAL-ASIAN STARLING.)

The only skins I took were in Jinjoret nullah about 7,500 feet in November. I have down a remark "common at about 4,500 feet from November to April" and a similar remark against the next mentioned species, of which I only took skins in March at Kesun about 4,500 feet. It is quite probable that this remark should apply only to the latter—*S. menzbieri*. The birds are indistinguishable except in the hand, a starling was undoubtedly common in those months. It was probably *menzbieri* as Fulton makes a similar remark about that bird and my *prophyronotus* were got higher up. On the other hand both Fulton's skins were taken in February, so both species may have been present low down in winter. On going over my rough field note-book, I note a Central-Asian Starling killed on 2nd April at Drosh.

(532) *Sturnus menzbieri*—(THE COMMON INDIAN STARLING.)

See above. It is more than likely that other similar starlings were present but remained unnoticed by either of us.

(542) *Agropsar sturninus.*—(THE DAURIAN MYNA.)

Not met with by me. Fulton got one cock out of a flock of some 17 birds on 16th July at the head of the Turikho Valley at 11,000 feet.

(544) *Temenuchus pagodarum*—(THE BLACK-HEADED MYNA.)

Very common summer visitor, arriving end of April up to 6,000 feet.

(549) *Acridotheres tristis*—(THE COMMON MYNA.)

Present all the year from 4,000 feet. Did not meet it higher than 6,000 feet.

FAMILY—MUSCICAPIDÆ.

*(557) *Muscicapa grisola.*—(THE SPOTTED FLYCATCHER.)

Fairly common at 7,000 feet in summer, not noticed in winter. They were breeding in June at Baradam 7,500 feet.

(558) *Hemichelidon sibirica*—(THE SOOTY FLYCATCHER.)

Procured at 7,500 feet at Baradam, where it was breeding in June.

(561) *Syphia parva*—(THE EUROPEAN RED-BREASTED FLYCATCHER.)

First seen 14th April when some half-dozen pairs were seen in Lower Drosh. A few were generally to be seen for about a month after. One pair, the only ones I saw during the summer, bred in the Upper Drosh garden. Fulton remarks that it is common in the orchards of Lower Chitral during the winter and as late as mid-April, and that possibly it is a resident. Probably local migration will explain this.

(589) *Alseonax ruficaudus*—(The Rufous-tailed Flycatcher.)

Fairly common at the Sanatorium nearly 7,000 feet in late May; it bred there later. Fulton records getting one at 4,000 feet in April so it is probably migratory to a certain extent.

(598) *Tersiphone paradisi*—(The Indian Paradise Flycatcher.)

No skin taken. Summer visitor, not numerous, nor seen as high as Drosh. First seen end of April.

Family—TURDIDÆ.

The waste stretches along the main valley between the cultivated bits on the side streams provide grand ground for finches, accentors, and especially for chat-like birds. Keeping in view that such birds have always been of the greatest interest to me, that the river, orchards, and cultivated lands could be worked on the same day, and that my job necessitated frequent trips up and down the main valley, it is small wonder that such ground received a good deal more than its fair share of attention especially during March and April, the spring migratory season. My notes fully meet my requirements as regards dates, &c., of arrival, departure, occurrence, nesting observations, &c.; but they sadly fail in the few instances where descriptions are required. In the case of the Chats my notes give the impression of having been bothered by the variations of plumage, *S. picata* and *S. pleschanka* being the offenders. Mention is made of a mixed marriage, but the name of the lady is unaccountably omitted. I must content myself with leaving disputed points alone. I hope these remarks will induce some other sojourner in Chitral or similar district to take up the question. I wish I had made a larger series of skins.

(608) *Pratincola caprata*—(The Common-pied Bush-Chat.)

Not seen by me. See also *P. maura*. Capt. Fulton remarks as under :—

"A resident. I obtained specimens among the scrub on the banks of the streams at 6,000 feet in the Bimboret nalla in February. I did not see them again till September, when large numbers arrived at Drosh evidently migrating south. I believe they breed in the country."

This remark was originally made against *P. maura*, but was subsequently corrected by him to refer to *caprata*.

(610) *Pratincola maura*—(The Indian Bush-Chat.)

A few were observed near Drosh in March, but the bulk of them arrived early in April. Most went further north or scattered, but a few bred between Drosh and Chitral, at least three pairs. Capt. Fulton added this to his original list at the same time that he made the correction about *P. caprata*. His amended remark reads :—

"I obtained one male only of this species in the Golan Valley in May at 6,000 feet."

Knowing both these chats well, I could hardly help thinking that Capt. Fulton had made a slip in their names. Mr. Kinnear kindly looked up his specimens and found four *maura* and one *caprata*, so it is evident that in his correction alluded to, *maura* should read *caprata* and *vice versâ*.

*(618) *Saxicola picata*—(THE PIED-CHAT.)

Arrived mid-April. Common. Breeds in the country about 5,000 feet upwards.

(619) *Saxicola capistrata*—(THE WHITE-HEADED CHAT.)

Not recorded by me, though I am not at all sure that I did not see it putting it down as a variety of *S. picata.* Fulton records it :—

"I obtained specimens at elevations of 7,000 to 11,000 feet during May, June and July. In May I found a nest at 7,500 feet at the foot of a small shrub."

(620) *Saxicola opistholeuca*—(STRICKLAND'S CHAT.)

By far the commonest Chat. First seen late in March, large numbers arrived early in April, scattered in early May, began to collect again with their young early in October. Bred from 5,000 up, many along the banks of the main river. The cock of my "mixed marriage" belonged to this species. The hen, I am nearly sure, belonged to *S. picata.* The hens of this species are very much darker than and easily distinguishable at sight from those of *picata.* Nests with young were common early in June.

*(621) *Saxicola pleschanka*—(THE SIBERIAN CHAT.)

Arrives a trifle earlier and is not so common, otherwise the remarks concerning *opistholeuca* apply also to this chat.

*(624) *Saxicola œnanthe*—(THE WHEATEAR CHAT.)

Not common. First seen 2nd April. One pair nested on the Lower Drosh farm about 4,200 feet.

*(628) *Saxicola chrysopygia*—(THE RED-TAILED CHAT.)

Rare, only a few seen in January and early February, near Drosh by the river on a waste stretch about 4,300 feet.

(630) *Henicurus maculatus*—(THE WESTERN SPOTTED FORKTAIL.)

Common on side streams, down to 4,000 feet in winter and a bit higher in summer. Breeds about 5,000 feet upwards.

(637) *Microcichla scouleri*—(THE LITTLE FORKTAIL.)

Common in winter down to 4,000 feet on side streams. Disappeared from mid-April till early in September. The Drosh Fort pair hung about till the end of June, when they too vanished after giving us false hopes of finding the nest. I have frequently seen them (in Chitral and elsewhere) plunge into the water ; in fact, I think, they get most of their food in this way. They always go up stream and apparently run along the bottom perhaps aided a bit by their wings, which seem to be kept half-open. I have seen them go up a steepish rock half-a-dozen times in about as many minutes, resting a little at the top and then flying to the bottom for another trip up, the water little more than covering the bird, but coming down with a force which, one would think, would render successful ascent on the apparently slippery surface impossible. I have seen them plunge but not so often in deeper and stiller water. They are not shy birds to start with, and, by only advancing when they are under water, one can get quite close. Fulton states that he never saw them plunge, and that they seemed to stick more to scrub, seldom being near the water like *H. maculatus.* My subsequent trapping experiences give the explanation of this, *i.e.*, that he did not see them feeding. They only feed in the morning (fairly early), about mid-day, and then again in the evening, retiring to adjoining scrub for siesta between whiles. Of course this only applies to my experiences, *i. e.*, between November and March. About 3 p.m. one day I marked one going into a small bush on a bare cliff overhanging the main branch of a stream near here. To the best of my belief he did not move till 6 p. m., when he came down to feed. I am sure my presence had nothing to do with his stopping there. I was some way off on the other side of the stream bed (fairly wide just there), trying to trap White-capped Redstarts on the other minor bifurcation of the stream, which was not his hunting ground at all. Several times after, a stone thrown into that bush from above at non-feeding times found him at home. The one specimen caught at last did not survive long, not enough individual attention at first I fear. His larger relative, though I did not succeed in even getting him on boardship, did very well in my aviaries; this bird is also given to siestas, but they are shorter.

(638) *Chimarrhornis leucocephalus*—(The White-capped Redstart.)

Fairly common in winter along streams down to 4,000 feet. going up higher in April. Seen in June about 6,500 feet. Fulton states that it is common in summer by streams from 7,000 to 12,000 feet. Like other stream-hunting birds it seems to divide off the stream into stretches. Each bird (or pair) sticks to it's own stretch, fighting off intruders.

(639) *Ruticilla frontalis*—(The Blue-fronted Redstart.)

No specimen obtained, but an unidentified Redstart twice noted near Drosh in February, belonged I am nearly sure to this species, which I afterwards got to know well, as an occasional winter visitor to my station.

(642) *Ruticilla erythronota*—(Eversmann's Redstart.)

Very common down to 4,000 on the waste stretches bushed parts in winter from November to February. Not seen after middle of March.

(644) *Ruticilla rufiventris*—(The Indian Redstart.)

First seen in mid-April about 4,500 feet round Chitral Fort where it was fairly common and remained so for a short time. It was common up the Mastuj Valley in May. Not seen again till September when it was fairly common round Drosh.

(644 *a*). *Ruticilla phoenicura.*—(The European Redstart.)

This is the first authentic specimen of this Redstart that has been recorded from British India, according to Mr. Comber. I only met with it at Buni up the Mastuj Valley, where it was common on both my visits in the middle of May. I only took three skins.

(645) *Ruticilla erythrogaster*—(Guldenstadt's Redstart.)

Only seen (bar one pair) in March and April, when it was common on the river and side streams about 4,500 feet. One pair hung about Lower Drosh till the end of June, giving us vain hopes of finding the nest. A pair (I fancy the same) were frequenting the same place in September. This attractive and conspicuous Redstart has, as Oates remarks, much the same habits as the

White-capped. It certainly also frequents rocky hill-sides as long as they are fairly close to water, I observed it hawking flies at a great height which I have never seen the White-capped do.

(646) *Rhyacornis fuliginosus*—(THE PLUMBEOUS REDSTART.)

Resident. Common in winter from 5,000 feet down and in summer from 4,000 to 6,000 feet possibly higher, but I do not think this bird moves up and down very much, though in India I have met both this and the White-capped in the plains at the edge of the foot-hills. The hen's helio like tail is most fascinating to watch. The cock has a charming little song, a fact I was unaware of till I kept them in my aviaries where the cocks were incessantly singing at each other through the very necessary wire separating them. The White-caps often fought but never sang.

(647) *Cyanecula suecica*—(THE INDIAN BLUE-THROAT.)

Not observed by me. Fulton records it as passing through Drosh going south in September and October.

* (651) *Calliope pectoralis*—(THE HIMALAYAN RUBY-THROAT.)

Two were put up out of a wheat field and the cock bagged, when after quail near Chitral Fort on 21st April. No more were seen, but birds of habits like this and the last are easily missed. The cock, as I have since ascertained, has a beautiful song.

(657) *Adelur cæruleicephala*—(THE BLUE-HEADED ROBIN.)

Not observed till early in March, when they were common from 4,000 feet upwards. They began to move higher up in April, but were present all the summer from 6,000 up. Major Sealy found a nest in a crevice under a fallen tree on 31st May on Kaogol about 7,000 feet. It contained four eggs of the type recorded by Wardlaw Ramsay.

(677) *Merula atrigularis*—(THE BLACK-THROATED OUZEL.)

Very common from 4,500 feet upwards from March till May, appearing again in October.

(678) *Merula unicolor*—(TICKELL'S OUZEL.)

No skin taken though several were shot and identified. Very common from March to May. Began to go up higher in May. A pair seen in June at 7,500, above Drosh. Seen again low down in end of September.

(691) *Petrophila cinclorhynca*—(BLUE-HEADED ROCK THRUSH.)

No skin. It is a bird I know well. Several pairs were seen in the summer in different places at about 7,000 feet or under. I saw it again with young in not fully adult plumage low down in October. I cannot understand my missing it on its way up. Fulton records it at 7,000 feet in May. MacMahon I believe, records the occurrence of the Chestnut-bellied Rock-Thrush (*P. erythrogastra*), but I cannot help thinking he misnamed this bird (*cinclorhynca*), a mistake commonly made.

(693) *Petrophila cyanus*—(THE WESTERN BLUE ROCK-THRUSH.)

First seen at the end of April, when it became very common till the end of May when they seemed to scatter. It remained fairly common from 4,500, up all the summer breeding even at the lower elevation. They began to collect again in the main valley in September.

(694) *Monticola saxatilis*—(THE ROCK-THRUSH.)

Not met with by me. Fulton records obtaining two females in September and October at 7,000 feet. "The former with an egg." Doubtless a precocious youngster.

(695) *Turdus viscivorus*—(THE MISSEL-THRUSH.)

Common in winter down to 4,500 feet and in summer down to about 6,500 feet, at which altitude I found a nest with four young on 28th May. Fulton records a nest at 12,000 feet, the bird, nests with four eggs, and tree being covered with snow on 26th April.

Probably other thrushes will be recorded. I am nearly sure that I saw Redwings in February near Drosh.

(703) *Cinclus asiaticus*—(THE BROWN DIPPER.)

Common from 4,000 feet up, going a bit higher in summer. A nest was found at Beori at 4,000 feet on 15th March with four practically fully fledged young and another at Ayon on 6th April at 4,500 feet with 5 young in the down.

* (712) *Accentor nepalensis*—(THE EASTERN ALPINE ACCENTOR.)

Fairly common round Drosh in November and March not lower than 6,000 feet, very common in small straggling flocks down to 4,500 feet along the roads from December to February. One was seen at 7,500, above Drosh on 8th April.

(716) *Tharrahaleus atrigularis*—(THE BLACK-THROATED ACCENTOR.)

Common in small parties of a dozen or so round Drosh down to 4,000 feet from November to March. A few seen in pairs to April about 5,000 feet.

(717) *Tharrhaleus fulvescens*—(THE BROWN ACCENTOR.)

Not quite so common, arrives a little later, departing earlier and keeps a bit higher, not seen in April, otherwise similar to above.

FAMILY—PLOCEIDÆ.

(734) *Uroloncha malabarica*—(THE WHITE-THROATED MUNIA.)

No skin. Only one small flock seen below Drosh on 3rd May. Fulton records them common in summer up to 4,000 feet.

FAMILY—FRINGILLIDÆ.

The list of "finches" is fairly long, but I am sure it can be added to.

(740) *Coccothraustes humii*—(HUME'S HAWFINCH.)

Not obtained, but I think I saw it near Gairat in May. Fulton records two specimens from Drosh in May, and believes that it breeds in the country.

* (741) *Pycnorhamphus icteroides*—(THE BLACK AND YELLOW GROSBEAK.)

Not uncommon in the cedar forests, down to about 6,500 feet in winter.

* (745) *Pyrrhula aurantiaca*—(THE ORANGE BULLFINCH.)

Only one hen obtained, sent in to me from Utzum about 7,500 feet on 29th March. A cock Bullfinch hung about the inside of Chitral Fort for most of January, I only saw it once, but believe it belonged to this species.

(754) *Propasser thura*—(The White-browed Rose-Finch.)

Not observed by me. Fulton records obtaining one cock on 30th April in Pattison nallah at 9,000 feet.

(755) *Propasser pulcherrimus*—(The Beautiful Rose-Finch.)

Not observed by me. Fulton records them common during April in the cedar forests between 6 000 and 10,000 feet, not seen in summer.

(757) *Propasser grandis*—(The Red-mantled Rose-Finch.)

A few were met with in January and April about 4,500 feet on the waste stretches. Fulton records them as fairly common on the wooded ridges from 7,000 to 9,000 feet in late April and early May.

(761) *Carpodacus erythrinus*—(The Common Rose-Finch.)

Very common in large flocks at about 4,500 feet at end of April and beginning of May. Seen up the Mastuj Valley in mid-May. Fulton records them common at the head of the Turikho Valley from 15,000 to 16,000 feet probably breeding there, and common in winter round Drosh.

(762) *Carpodacus severtzovi*—(Severtzoff's Rose-Finch.)

Not met with by me. Fulton records a good many at Gharagar at 13,000 feet just below the snow-line on 10th July.

* (763) *Erythrospiza githaginea*—(The Desert-Finch.)

One specimen obtained. Not so common as the next species.

(764) *Erythrospiza mongolica*—(The Mongolian Desert-Finch.)

There were large flocks present in the main valley near Ghairat and further in March, April, and May. A few were seen in November. These flocks contained smaller flocks of two somewhat similar birds, differing a bit in habits. One species, *mongolica*, was far commoner than *the other githaginea*. Fulton records getting a pair at the head of the Turikho Valley at 10,000 feet on 9th July.

(764a) *Rhodopechys sanguinea.*

Not seen by me. Fulton saw two (of which he got one) at Roah in the Turikho Valley at 10,000 feet which constitutes the first record within Indian limits.

(764b) *Rhodospiza obsoleta.*

No skin. A few were several times seen in November just above the junction of the Shishikho with the main river. They used to be procurable alive most winters in Pindi or Lahore under the name of "Kabul Gulabi," but I have heard of none for the last few years. I believe they have since been recorded from Quetta, so my omission to procure a skin is not of much consequence.

(767) *Carduelis caniceps*—(The Himalayan Gold-Finch.)

Fairly common in small flocks at about 4,500 feet in the winter from November to March, collecting in large flocks in April previous to going further up the hill. Seen in large flocks at Buni in mid-May. Fulton records them as common in summer at about 12,000 feet, breeding in July.

(768) *Callacanthis burtoni*—(THE RED-BROWED FINCH.)

Not observed by me. Fulton records it as summer visitor, getting specimens in the Deodars in August from 8,000 to 9,000 feet.

(770.) *Acanthis brevirostris*—(THE EASTERN TWITE.)

Not observed by me. Fulton records it as fairly common on the high grazing grounds from 10,000 to 14,000 feet in July and August; he obtained a nest at 13,000 feet.

(771) *Metoponia pusilla*—(THE GOLD-FRONTED FINCH.)

Fairly common in small flocks at about 4,500 feet from November to March collecting in large flocks, probably increased by new arrivals in April, a few seen in May at that height. Fulton records them common on the Turikho at 12,000 feet where they were nesting in July.

(774) *Fringilla montifringilla.*—(THE BRAMBLING.)

Only observed in April when large flocks passed through Drosh on their way north.

(776) *Passer domesticus*—(THE HOUSE-SPARROW.)

Arrive end of April (first seen 20th), beginning to leave early in October, very common at about 4,500 feet. Nested mostly in holes in trees, only a few apparently finding sites in the houses, such being previously occupied by *P. montanus.* Several colonies were found nesting fairly high up in the smaller branches of trees in the orchards. The nest consisted of a large untidy ball of straw, in the middle of which was the nest proper of hay and the usual rubbish; the entrance at the side was not easy to detect. Fulton noted it as far up the valley as Sanoghar 7,800 feet.

(778) *Passer hispaniolensis*—(THE SPANISH SPARROW.)

Very common in large flocks round Drosh in October and November, not seen in winter nor in summer. Arrived in large flocks right at the end of April staying only about a fortnight.

(779) *Passer montanus*—(THE TREE SPARROW.)

Very common all the year, from 4,000 feet up, nesting from April to August, mostly in buildings, as far as such accommodation went. My notes tally exactly with Fulton's.

(780) *Passer cinnamomeus*—(THE CINNAMON TREE SPARROW.)

Fairly common in small parties in the lower wooded valleys at 4,000 feet in winter. Fairly large flocks seen near Drosh in April. Met breeding in May at about 6,000 feet, not seen lower than this in summer.

(787) *Fringillauda sordida*—(STOLICZKA'S MOUNTAIN-FINCH.)

Several small flocks seen near Drosh at about 5,000 feet in early April. Fulton records having seen them at 6,000 feet in April and May, and found them common at 10,000 to 14,000 feet in July.

(788) *Fringillauda brandti*—(BRANDT'S MOUNTAIN-FINCH.)

Not observed by me. Fulton found them numerous in Bangol at 13,000 feet up in July, but saw them nowhere else.

(790) *Emberiza fucata* —(THE GREY-HEADED BUNTING.)

No skin. I shot and identified this bird at Reshan in the Mastuj Valley in May, fairly common. Not observed elsewhere, but may have been present.

* (792) *Emberiza leucocephala*—(THE PINE-BUNTING.)

Common about Drosh in December and January becoming very common in February and March. None seen in April or later.

(793) *Emberiza stewarti*—(THE WHITE-CAPPED BUNTING.)

Not seen in winter. Were very common in the main valley at about 5,000 feet towards the end of April and a bit higher up in May. Breed in June and July as low as 5,500 feet, not uncommon.

(794) *Emberiza stracheyi*—(THE EASTERN MEADOW-BUNTING.)

Common in winter down to 4,000 feet from October to early May, when they go higher up, probably found above 8,000 feet, according to my notes. Fulton saw numerous young in June and July at 9,000 to 14,000 feet.

* (795) *Emberiza buchanani*—(THE GREY-NECKED BUNTING.)

Only one cock obtained in May at 5,000 feet; but there were probably others also feeding with the flocks of *stewarti* and *stracheyi*. It is very likely that other buntings were also present but undetected.

* (799) *Emberiza melanocephala*—(THE BLACK-HEADED BUNTING.)

No skin preserved and identification not quite certain. They were common about Drosh in late October. The skins I took were not "in plumage" and were destroyed by some puppies. However, I got to know this bird well afterwards through keeping it alive, and am nearly sure my identification was correct.

(800) *Emberiza luteola*—(THE RED HEADED BUNTING.)

Only one pair obtained on 2nd and 3rd May near Drosh, no more seen till late September when, what I am nearly sure was this species, were fairly common. Fulton records them as arriving towards the end of March on the northward migration.

(801) *Emberiza rutila*—(THE CHESTNUT BUNTING.)

Not met with by me. Fulton records obtaining only one male in the Golan Valley at 7,000 feet in April.

FAMILY—HIRUNDINIDÆ.

(805) *Chelidon kashmiriensis*—(THE KASHMIR MARTIN.)

Common in summer, arriving in late April. Breeds about 4,500 feet.

(808) *Cotile riparia*—(THE SAND-MARTIN.)

Not observed by me. Fulton notes as common from April to October.

(810) *Ptyonoprogne rupestris*—(THE CRAG-MARTIN.)

Summer visitor, common, arrived early April, breeds from 4,500 feet. Fulton met it at 13,000 feet.

* (813) *Hirundo rustica*—(THE SWALLOW.)

Common summer visitor, arrived early May, breeds at 4,500 feet.

(824) *Hirundo rufula*—(THE EUROPEAN STRIATED SWALLOW.)

Common summer visitor, arriving the end of March. Breeds from 4,000 feet. An unfinished nest was found on 8th May as low down as Nagar.

FAMILY—MOTACILLIDÆ.

(826) *Motacilla alba*—(THE WHITE WAGTAIL.)

First seen early in April, common; breeds at about 5,000 feet. Fulton records it as present through the year from 4,500 to 10,000 feet, according to season.

(829) *Motacilla personata*—(THE MASKED WAGTAIL.)

Common throughout the year breeds at about 5,000 feet in May-June.

° (830) *Motacilla hodgsoni*—(HODGSON'S PIED WAGTAIL.)

First observed 25th March but on sight without careful observation it is except in summer, so like the last that it may have easily escaped observation. A specimen obtained on 25th March had all the "back parts" pure black, while another killed on the 6th April had only traces of black on those parts as had others killed some time later. Both species were breeding within a few yards of each other at Ayon in June, where both were common. There was one case of an apparent "mixed marriage," but they had young, and I did not like to take the parents.

(832) *Motacilla melanope*—(THE GREY WAGTAIL.)

Present in the winter, but not common, about 4,500 feet, going higher up in summer. Large numbers present near Drosh in April. Breed as low down as 5,500 feet but commoner a bit higher.

(835) *Motacilla beema*—(THE INDIAN BLUE-HEADED WAGTAIL.)

Not recorded by me, but I think some Wagtails I saw in April were of this species. Fulton records them as passing through in numbers in April.

(838) *Motacilla citreoloides*—(HODGSON'S YELLOW-HEADED WAGTAIL.)

Arrived in fair numbers at the end of March on the way up higher (or further north). Some stay for the summer as low as 6,000 feet but not common, apparently breeding. Fulton met one pair at 10,000 feet in July. Some of my specimens obtained in March (along with undoubted *citreoloides*) had no trace of black on the upper parts and may, of course, be *M. citreola*.

(840) *Anthus trivialis*—(THE TREE-PIPIT.)

First observed at the beginning of April quite common at about 4,500 feet in April and May, disappearing (probably to go higher) in June, re-appearing early in September. Fulton believes it to be present through the year from 5,000 to 12,000 feet according to season.

° (844) *Anthus similis*—(THE BROWN ROCK PIPIT.)

A fairly common summer visitor, appearing at the beginning of April, at about 4,500 feet and breeding about that height.

Anthus, sp.—(A PIPIT.)

A pipit was very common in winter at about 4,500 feet, disappearing in the middle of March. Unfortunately the only two skins I took were destroyed. I put it down as *A. sordidus*; it was like *A. similis*, but not so large or bright, and the third outer tail feathers were "pale-tipped," the legs were dark reddish-brown.

FAMILY—ALAUDIDÆ.

(855) *Otocorys penicillata*—(GOULD'S HORNED LARK.)

There were two flocks of about a dozen each near Ghairat about 5,000 feet in the early part of March. I saw a few near Laspur, pretty close to the Shandur Lake in May. Fulton saw them at 13,000 feet at the head of the Turikho in July.

(859) *Melanocorypha bimaculata*—(THE EASTERN CALLANDRA LARK.)

Large flocks passed up the main valley during early March.

(860) *Alauda arvensis*—(THE SKY-LARK.)

Some present in the winter low down, very common in March, some present in April after which they disappeared, probably going higher. Fulton obtained fully fledged young at 11,000 feet at the end of June.

(862) *Calandrella brachydactila*—(THE SHORT-TOED LARK.)

Very common in small flocks in April as they passed through Drosh. Fulton notes their return southward, passing through Drosh in large numbers in first week of October.

(864) *Calandrella tibetana*—(BROOKS'S SHORT-TOED LARK.)

Not observed by me. Fulton records two from Sonoghar (8,000 feet) in May.

* (865) *Calandrella acutirostris*—(HUME'S SHORT-TOED LARK.)

Two obtained at Orgutz on 10th May, indistinguishable at sight from *brachydactyla*. Seen in small flocks.

*(874) *Galerita cristata*—(THE CRESTED LARK.)

A not common summer visitor, arriving in mid-April, remaining to breed, not seen much above 4,200 feet.

FAMILY—PICIDÆ.

(946) *Gecinus squamatus*—(THE WEST-HIMALAYAN SCALY-BELLIED GREEN WOODPECKER.)

Common throughout the year from 4,000 feet up.

(961) *Dendrocopus himalayensis*—(THE WESTERN HIMALAYAN PIED WOODPECKER.)

Common throughout the year from about 5,000 feet up.

(969) *Dendrocopus auriceps*—(THE BROWN-FRONTED PIED WOODPECKER.)

Not observed by me. Fulton records it as common from 4,000 to 11,000 feet.

(1003) *Iynx torquilli*—(THE COMMON WRYNECK.)

Only one specimen obtained at Drosh on 2nd May at about 4,300 feet.

FAMILY—CORACIADÆ.

(1024) *Coracias garrula*—(THE EUROPEAN ROLLER.)

Arrive the beginning of May, most pass on northward after a short stay, but a fair number breed in the country. They seem far more secretive about their nests than the Indian Roller. It was not till they had young (in mid-July) that we discovered a nest in a tree in the cliff over hanging the river by Lower Drosh, and then only by a fluke.

FAMILY—MEROPIDÆ.

(1029) *Merops apiaster*—(THE EUROPEAN BEE-EATER.)

Arrive the end of May, most passing on northward, but a number stay to breed in the country at about 4,500 feet, young seen about in August. One nest we dug out on 20th September contained a young bird, fully fledged ; in fact, it must have left the nest a long time.

FAMILY—ALCEDINIDÆ.

*(1035) *Alcedo ispida*—(THE COMMON KINGFISHER.)

Several were seen in April on the main river between Nagar and Kesun. Solitary birds were seen on the same part at intervals all the year.

FAMILY—UPUPIDÆ.

(1066) *Upupa epops*—(THE EUROPEAN HOOPOE.)

Fairly common summer visitor, first seen about 4,500 feet at the end of March going up a good deal higher at the end of April. I met it some way above Laspur in May.

FAMILY—CYPSELIDÆ.

(1068) *Cypselus melba*—(THE ALPINE SWIFT.)

Common in summer passing overhead, arriving end of March.

(1069) *Cypselus apus*—(THE EUROPEAN SWIFT.)

Very common summer visitor, arriving in mid-April.

FAMILY—CUCULIDÆ.

(1104) *Cuculus canorus*—(THE CUCKOO.)

Fairly common summer visitor from 4,500 feet up, first seen end of April.

FAMILY—PSITTACIDÆ.

(1141) *Palæornis schisticeps*—(THE SLATY-HEADED PAROQUET.)

Fairly common summer visitor at 4,000 feet up, arriving early in April.

FAMILY—ASIONIDÆ.

*(1156) *Asio otus*—THE LONG-EARED OWL.

One specimen obtained at Drosh on 2nd May.

(1159) *Syrnium biddulphi*—(SCULLY'S WOOD-OWL.)

Fairly common I fancy in winter about 4,500 feet, not observed in summer.

(1167) *Bubo ignavus*—(THE GREAT HORNED OWL OR EAGLE OWL.)

No skin, but there was a bird which could only have been of this species hanging about the Lower Drosh farm for a week or so in December. Fulton records getting two in December in Drosh.

(1173) *Scops giu*—(THE SCOPS OWL.)

Every orchard from 4,000 feet up seems to hold this bird in summer, not noted in winter, the whistle-hoot "hoo-hoo" was first heard in April. I took some young in down of various ages from a nest on 13th July, and most charming pets the comical little chaps made.

*(1186) *Glaucidium brodiei*—(THE COLLARED PIGMY OWLET.)

Only one specimen obtained at about 5,000 feet in February. Probably many other owls are present.

FAMILY—VULTURIDÆ.

(1198) *Neophron percnopterus*—THE EGYPTIAN VULTURE OR LARGE WHITE SCAVENGER VULTURE.

No skin, I rather fancy both species were present round Drosh in summer.

FAMILY—FALCONIDÆ.

Chitral abounds in "hawks" as one would expect, and I am sure the list could be doubled. It seems a shame to shoot some species. I still regret having shot a magnificent Fishing Eagle at the instance of a Chitrali who feared for his hawks. Some on the other hand are so numerous that they become a nuisance and have to be treated as vermin.

(1199) *Gypaetus barbatus* (THE BEARDED VULTURE OR LAMMERGEYER.)

No skin Common throughout the year, down to 4,000 feet in winter.

(1208) *Hieraetus pennatus*—(THE BOOTED EAGLE.)

This bold bird is common from 4,000 feet up. Chitralis dislike him immensely, as his presence in the neighbourhood renders hawking an impossibility. I have never seen one domesticated (I hope falconers will excuse my ignorance of correct terms). In spite of its rather clumsy build, it can put the fear of death into a laden shahin, which is itself a marvellous flyer.

* (1223) *Haliaetus leucoryphus*—(PALLAS'S FISHING-EAGLE.)

One specimen obtained out of a pair near Chitral Fort on 10th May.

* (1229) *Milvus govinda*—(THE COMMON PARIAH KITE.)

No skin. I am under the impression that this and *M. melanotis* were present round Drosh in the summer, but cannot be sure.

(1230) *Milvus melanotis*—(THE LARGER INDIAN KITE.)

No skin. Fulton records one specimen obtained at 6,000 feet on 16th April.

(1232). *Elanus cæruleus.*—(THE BLACK-WINGED KITE)

Not observed by me, though doubtless I saw it, as Fulton says it is common in summer in the lower wooded valleys.

(1233). *Circus macrurus*—(THE PALE HARRIER.)

Not observed by me, but there were many harriers in the main valley in April and May. Fulton records one from Drosh in April.

* (123) *Circus cyaneus*— THE HEN HARRIER.)

Two specimens obtained in April and May below Drosh.

* (1237) *Circus æruginosus*—(THE MARSH HARRIER.)

Two specimens obtained in April and May below Drosh.

* (1245) *Astur palumbarius*—(THE GOSHAWK.)

Not seen by me. They are caught in the higher ranges.

(1247) *Accipiter nisus*- (THE SPARROW HAWK)

Saw several of what were probably this bird in April and May. I saw a good many fresh-caught ones obtained at no great height. Fulton got it.

(1255) *Falco peregrinator*—(The Shahin Falcon.)

Met with several times. Near Drosh on 27th April, I shot one which was carrying a Myna. The Myna escaped when I shot the falcon. About the finest flying spectacle I have ever seen was given by a wild bird hawking a tame one. I do not think the owner was as pleased as I. To my mind hawking crows with a Peregrine or Shahin is far finer than going for Chukor with a Goshawk.

(1260) *Falco subbuteo*—(The Hobby.)

Not noted by me. Fulton records one from Reshan, 6,000 feet in May.

(1264) *Æsalon chicquera*—(The Turumti or Red-headed Merlin.)

Not seen by me. At Reshan in May I saw one freshly caught near by.

(1265) *Tinnunculus alaudarius*—(The Kestrel.)

Common throughout the year from 4,000 feet up, especially in March and April.

Family—COLUMBIDÆ.

(1292) *Columba intermedia*—(The Indian Blue Rock-Pigeon.)

Flocks of Blue pigeon were common in the winter at about 5,000 feet, but it was impossible to tell which form they belonged to, except those that were shot I identified a good many beside those I shot myself. From December to March only *intermedia* and *rupestris* were obtained, in April only *livia* were obtained. Fulton records *intermedia* as common up to 10,000 feet.

(1293) *Columba livia*—(The Blue Rock-Pigeon.)

(1294) *Columba rupestris*—(The Blue Hill Pigeon.)

(1296) *Columba leuconota*—(The White-bellied Pigeon.)

Common in winter down to about 5,000 feet. Fulton found them not uncommon in summer from 11,000 to 14,000 feet.

(1298) *Palumbus casiotis*—(The Eastern Wood-Pigeon, Ring-Dove, or Cushat.).

Seen in the wooded parts in small parties in November and again in May at about 6,000 feet, and in larger parties in July.

(1305) *Turtur ferrago*—(The Indian Turtle-Dove.)

A common summer visitor from 4,000 feet up, arriving end of April.

(1307) *Turtur suratensis*—(The Spotted Dove.)

A common summer visitor arriving end of April, from 4,000 feet up.

(1309) *Turtur cambayensis*—(The Little Brown Dove.)

Remarks as for *T. ferrago*.

(1310) *Turtur risorius*—(The Indian Ring-Dove.)

Remarks as for *T. ferrago*.

Family—PHASIANIDÆ.

(1334) *Pucrasia macrolopha*—(The Koklas or Pukras Pheasant.)

Not observed by me, but it is without doubt common, see Fulton's notes. A live bird caught at about 7,000 feet above Drosh was brought in to me in November.

(1342) *Lophophorus refulgens.*—(The Monal.)

No skin. Common in winter at 6 000 feet occasionally as low as 5,000 feet. Fulton records it at 10,000 feet and higher in summer.

(1355) *Coturnix communis*—(The Common or Grey Quail.)

Fair number continue passing through the country throughout April and May.

(1370) *Caccabis chucar*—(The Chukor.)

Very common all the year, coming down as low as 4,000 feet in winter. Fulton records it as high as 12,000 feet in summer.

(1378) *Tetraogallus himalayensis*—(The Himalayan Snow-Cock.)

Common in winter as low down as 6,000 feet. Fulton records them with young in July between 15,000 and 16,000 feet.

Family—RALLIDÆ.

In all probability many species pass through on migration in April and May. Two rails were brought in to me in May. Their condition (crawling) was no inducement to prolonged identification. I put them down as *Porzana parva* and *P. maruetta.*

* (1402) *Gallinula chloropus*—(The Moorhen.)

One obtained at Nagar on 30th March, fairly common passing through in May.

(1405) *Fulica atra*—(The Coot.)

One obtained at Drosh on 15th February, fairly common passing through in end of April and beginning of May.

Family—CHARADRIIDÆ.

(1436) *Vanellus vulgaris*—(The Lapwing or Peewit.)

Fairly common in winter in the main valley, not seen after May.

(1437) *Chettusia gregaria*—(The Sociable Lapwing.)

Remarks as for the Peewit.

* (1447) *Ægialitis dubia*—(The Little Ringed Plover.)

Fair number pass through in April.

* (1454) *Numenius arquata*—(The Curlew.)

A few pass through at end of April.

(1460) *Totanus hypoleucus*—(The Common Sandpiper.)

Specimens only obtained at end of April, evidently passing through.

(1461) *Totanus glareola*—(The Wood Sandpiper.)

Remarks as for *T. hypoleucus.*

(1462) *Totanus ochropus*—(The Green Sandpiper.)

Specimens obtained throughout the year at about 4,500 feet, commonest at end of April. They bred near Drosh.

* (1464) *Totanus calidris*—(The Redshank.)

A few pass through at end of April.

(1471) *Tringa minuta*—(THE LITTLE STINT.)

Not observed by me. Fulton records them as common in April and May. On migration.

(1480) *Phalaropus hyperboreus*—(THE RED-NECKED PHALAROPE.)

Not noted by me. Fulton obtained one at Drosh on 14th September.

(1482) *Scolopax rusticula*—(THE WOODCOCK.)

No skin, noted at several places in the main valley during April. Fulton records them as not numerous, but present all the year in the wooded valleys of Lower Chitral. He found them in June at 7,000 feet and notes that they evidently breed in the country.

(1484) *Gallinago cœlestis*—(THE FANTAIL SNIPE.)

A few were seen for about a week in early March. Seen again and more numerous from mid-April to end of May.

(1486) *Gallinago solitaria*—(THE HIMALAYAN SOLITARY SNIPE.)

Not noted by me for certain, but am nearly sure I saw this bird at Drosh in January and again near Ayon at 5,500 feet in April. Fulton records a few.

* (1487). *Gallinago gallinula*—(THE JACK SNIPE.)

A few present in the middle of May, on migration.

FAMILY—LARIDÆ.

(1490) *Larus ridibundus*—(THE LAUGHING GULL.)

A few pass up from end of March to end of May.

* (1495) *Larus cachinans*—(THE YELLOW-LEGGED HERRING-GULL.)

One obtained in January at Drosh.

* (1496) *Hydrochelidon hybrida*—(THE WHISKERED TERN.)

Fairly numerous in middle of May between Buni and Reshan. None seen there a week later, apparently on migration.

* (1499) *Sterna anglica*—(THE GULL-BILLED TERN.)

A fair number of Terns passed up during end of April and May. Those obtained (two) were of this species.

FAMILY—PHALACROCORACIDÆ.

* (1526) *Phalacrocorax carbo*—(THE LARGE CORMORANT.)

A few pass up in early March, more in April.

FAMILY—ARDEIDÆ.

(1555) *Ardea cinerea*—(THE COMMON HERON.)

A few passed through during April and May.

* (1561) *Herodias garzetta*—(THE LITTLE EGRET.)

One specimen only obtained below Drosh on 8th May. No more seen.

FAMILY—ANATIDÆ.

(1583) *Anser indicus*—(THE BARRED-HEADED GOOSE.)

Not seen by me, but geese were heard passing in March. I saw the tamed birds mentioned by Fulton.

(1592) *Anas boscas*—(THE MALLARD.)

Pass southwards end of October, perhaps earlier, pass northwards during March.

* (1593) *Anas pœcilorhyncha*—(THE SPOTTED-BILLED DUCK.)

One out of a small party of four, undoubtedly of this species, was obtained at Ayon on 6th February. I very much regret not having sent down the skin as its occurrence so far into the mountains is interesting; future observers might keep a look-out for it in summer on the Shandur Lake, where I believe a great many ducks and other water birds breed.

(1597) *Nettium crecca*—(THE COMMON TEAL.)

Passing south in fair numbers at the end of October, probably earlier. Passing north in larger numbers during March and April. A few stay for the winter.

(1599) *Mareca penelope*—(THE WIGEON.)

Passes north during March and early April.

(1600) *Dafila acuta*—(THE PINTAIL.)

Passes north during end of February and April.

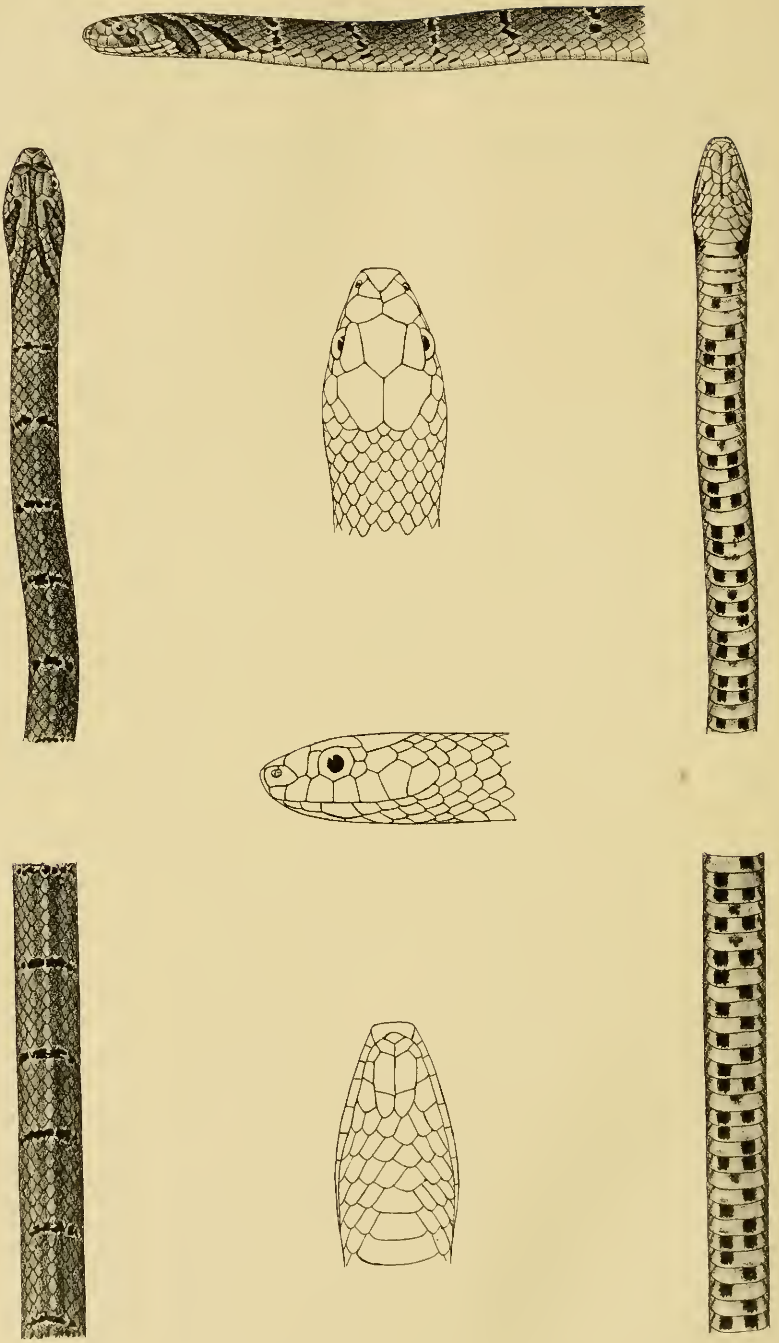
* (1601) *Querquedula circia*—(THE GARGANEY OR BLUE-WINGED TEAL.)

Passes north during April and beginning of May.

(1602) *Spatula clypeata*—(THE SHOVELLER.)

No skin. Observed in April.

Journ. Bombay Nat. Hist. Soc.



J. Green del. et lith.

NEW SNAKE FROM ASSAM.
Oligodon erythorhachis

A NEW SNAKE FROM ASSAM.

OLIGODON ERYTHRORHACHIS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

(*With a Plate.*)

Among other snakes sent to me from Namsang, Jaipur, Assam, by Mr. C. Gore, I find one belonging to the genus *Oligodon*, which has not been previously described. It is a ♀ ?, measuring 1 foot $2\frac{3}{4}$ inches, of which the tail accounts for $2\frac{3}{4}$ inches.

Lepidosis.—*Rostral* touches 6 shields, the rostro-nasal and rostro-internasal sutures subequal, and nearly twice the rostro-labials. *Internasals* a pair, the suture between them nearly equal to that between the præfrontal fellows, less than half the internaso-præfrontals. *Præfrontals* a pair, the suture between them less than half the præfronto-frontals; in contact with internasal, nasal, 2nd labial, præocular, supraocular and frontal. *Frontal* touches 6 shields, the supraocular sutures rather longest. *Supraoculars* length about four-fifths, breadth less than half that of frontal. *Parietals* touch one postocular. *Nasals* undivided, in contact with the 1st and 2nd labials. *Loreal* absent, (perhaps confluent with the præfrontal). *Præocular* one. *Postoculars* two. *Temporal* one, touching the 5th and 6th labials. *Supralabials* 7; the 3rd and 4th touching the eye. *Infralabials* 4, the 4th largest, and in contact with two scales behind. *Sublinguals* two pairs, the posterior about $\frac{2}{3}$rds the length of the anterior, and in contact with the 4th only of the infralabial series. *Costals* two head-lengths behind the head 15, midbody 15, two head-lengths before the anus 13. In the reduction from 15 to 13, the 3rd and 4th rows above the ventrals unite. Vertebrals not enlarged. Ultimate row barely enlarged. No keels. No apical pits. *Ventrals* 154, not angulate. *Anal* divided. *Subcaudals* 46 pairs.

Colour.—The dorsal ground colour is dark grey, but when looked at closely, this effect is produced by a very fine powdering of black specks on a light grey ground. A bright red vertebral band passes from the nape to the tail tip, involving the vertebral, and one and a half rows on each side. Narrow, black, light-edged cross-bars pass over the back, 29 on the body, 7 on the tail, and become more or less broken up in the flanks. The dorsal ground colour extends well on to the sides of the ventrals. The head is marked with a dark band over the præfrontals which re-appear below the eye, oblique streaks from the parietals, behind the gape to the side of the neck, and an elongate, sagittiform mark on the nape, the apex of which meets the præfrontal band. The belly is whitish and handsomely adorned with squarish black spots, for the most part laterally disposed. A median red stripe passes along the belly and beneath the tail, disappearing anteriorly before the throat.

HISTORY OF THE SEA COCOA-NUT (*LODOICEA SECHELLARUM*, Labill.).

BY

E. BLATTER, S. J.

There is scarcely any other palm which has been so little known and was yet the most celebrated formerly as the Sea Cocoa-nut or Double Cocoa-nut[1]. The French call it Coco de mer, Coco de Salomon, and Coco des Maldives, and it was known to the writers of the 16th and 17th centuries under the names of Nux Medica and Cocos Maldivicus. Before the exploration of the Seychelles in 1743, by order of Mahé de la Bourdonnais, then Governor of Mauritius, the nuts were only known from having been found floating on the surface of the Indian Ocean, and near the Maldive Islands, whence their French name was derived, and even in the time of Rumphius[2] the nut was spoken of as the " mirum miraculum naturæ, quod princeps est omnium marinarum rerum, quæ raræ habentur".[3]

The first European who described this famous fruit was the Portuguese Garcia d'Orta (Garcia ab Horto)[4]. He was physician to the Viceroy at Goa for about 30 years. In this capacity he found leisure for private study which he spent in the exploration and description of the useful plants and drugs of the country. In 1563 he published the results of his investigations in his " Coloquios da India ",[5] which were soon translated into several modern languages, and into Latin by

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[1] Other names for the same nut are: Narajile-bahri (Arab. Pers.); Jahari-narial (Bomb.); Peule-on-si (Burm.); Darya-ka-narel (Guz., Hind. Duk.); Mudu-pal (Sing.); Katal-tenna (Malay.); Kaddet-taynga (Tam.); Samudrapu-tenkaya (Tel.); Coco das Maldivas, Coco do mar (Portug.) : Meercocos, Seecocos, Doppelte Cocosnuss, Wundernuss Salomon's, Maldivische Nuss (Germ).

Rumphius (Rumpf George Eberhard) was born at Hanau in 1627 and died in 1702. He is called the " Plinius indicus ", because he described and figured a great number of plants whilst stationed in Amboina. His manuscripts and drawings have been published in 6 volumes under the title " Herbarium amboinense ", Amsterdam. 1741-1755.

Cf. Curtis, Bot. Mag., Vol I. (new series) 2734—38, (1827).

[4] Cf. D. G. Dalgado, Classificaçao Botanica das Plantas e Drogas descriptas nos " Coloquios da India " de Garcia d'Orta, Bombaim, 1894.

[5] Garcia d'Orta, Coloquios da India, Goa, 1563.

The latest Portuguese edition was published in Lisbon in 1872.

Clusius[1] in the year 1567. This work went through many editions, and it is in the one of 1605 that we read the following account of the "Coccus de Maldiva". [2] "This nut, and especially the kernel, are recommended by the inhabitants of those Islands (Maldive Islands) as a remedy against poison. I have been told by many trustworthy people that it proved useful in colic, paralysis, epilepsy, and other nervous diseases, and that the sick become immune against other diseases, if they drink water that has been kept in the shell for some time, and to which has been added a piece of the kernel. But as I have no personal experience I am not inclined to believe in these things. I had no time to make experiments and I prefer to use medicaments whose virtues are known to me and shown by experience, as, *e.g.*, the bezoar stone, theriac, and many other medicines, than new ones which are less reliable, because I do not know whether I have to adscribe to imagination only what people say about the beneficent effects of that nut. If, however, in the course of time, some facts will be verified, I shall not feel ashamed to change my opinion. The skin of the nut is black and smoother than that of the common Cocoa-nut, mostly ovate and not quite as round as the common nut. The kernel or inner pulp is hard and white when dry, sometimes slightly pallescent, full of cracks and very porous. The dose of the kernel is about 10 grains, taken in wine or water, according to the nature of the disease. The nuts are sometimes very large, sometimes small but they are always found thrown upon the shore. There is, besides, the common opinion that the Maldive Islands formed once part of a continent[1] which by an inundation of the sea disappeared, those islands alone being left; the palms, however, that produced those nuts, were buried underground and the nuts themselves became petrified in the way we find them now. Whether those palms belong to the same genus as our nut is difficult to say, as nobody up to now was able to see either the leaves or the stem of that plant. Only the nuts are washed ashore, sometimes in pairs, sometimes single; but nobody is allowed to collect them on penalty of death, because everything that is carried ashore belongs to the king. This circumstance has added a good deal to the value of these nuts. The pulp or medulla is then removed and dried in the same manner as our "Copra," till it becomes hard like the one you see in the market. In this condition you might easily mistake it for cheese." To this account Clusius adds the following note: "I have seen vessels made of this nut in Lisbon as well as in other places; they are usually more oblong and darker than those made of the common Cocoa-nut. You can even find the dried medulla of the nut in the market of Lisbon; its virtues are highly praised and it is preferred to almost all other alexipharmics. For this reason it is sold very dear. But you can easily gather from our author, how little faith such fabulous virtues deserve."

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[1] Clusius, Carolus (De le Cluse, Charles) was born at Antwerp in 1526 and died in 1609 His works are very numerous, for he not only published original descriptions of new plants, but he translated into Latin works from the French, Spanish, and Portuguese, thus rendering a most important service in the diffusion of a knowledge of the plants that were known in his day. Few men have suffered more in following a favourite pursuit than Clusius. He has on this account been called "The Martyr of Botany". As early as his twenty-fourth year, by excessive fatigue he contracted a dropsical disease. At the age of thirty-nine he broke his right thigh during one of his botanical rambles, and a short time after his right arm. Whilst at Vienna, he dislocated his left ankle, and eight years after this accident he dislocated his right hip. For this he was treated unskilfully, and ever after he was obliged to use crutches for support. During his exertions in the early part of his life he also contracted a hernia, which troubled him to the end of his days. But his bodily infirmities never diminished his mental activity, and he continued teaching and writing to the very last.

[2] "Aromatum et Simplicium aliquot medicamentorum apud Indos nascentium Historia conscripta a D. Garcia ab Horto, Proregis Indiæ Medico" in "Caroli Clusii Atrebatis Exoticorum Libri Decem", pp. 190-192 (1605).

Whilst Garcia d'Orta was staying at Goa, a Spaniard, Cristobal da Costa (Christophorus a Costa), of the medical profession, left his home with the only desire to "observe and study the various plants which God had created for the benefit of man in the different countries and provinces." On his tour he came to Goa where he met his colleague Garcia d'Orta. From the personal intercourse with him as well as from d'Orta's book he received most of the information which sometime after was published in Spanish and translated into Latin by Clusius[2] in the year 1572. Regarding the Sea Cocoa-nut we read in his book: "The 'Coccus de Malediva' is in such high esteem with the natives of that Island and with the people of Malabar, not only with the lower classes but also with kings and princes, that in all sickness they confide in that fruit as in a sacred anchor. They make of it drinking cups in which there is a piece of the kernel hanging from a small chain and they are strongly convinced that whosoever has drunk water from such a cup, is immune against every poison and disease. I saw, however, a good many that drank from those cups and fell sick nevertheless. In spite of my careful observations I never noticed that anybody was cured by such a drink. Some even assured me that after a draught from such a cup the spleen and kidneys got inflamed. The price of these nuts is, nevertheless, very great, a single nut without any ornaments being sold for 50 and more gold pieces."

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[1] That India and the southern and central parts of Africa were united in Mesozoic times into one great stretch of nearly continuous dry land is now proved by overwhelming evidence, taken from the Jurassic fossils as well as from the Cretaceous deposits. The great revolutions in physical geography, which took place towards the end of the Cretaceous and during early Tertiary times, resulted in the break-up of the old continent, and were followed by the rise of the Himalayan range. It would be highly interesting to trace the origin of the opinion expressed by Garcia d'Orta. Is it not possible that within historic times those islands were shaped into their present form?

[2] "Aromatum et medicamentorum in Orientali India nascentium historia, plurimum locis adferens iis quæ a Doctore Garcia de Orta in hoc genere scripta sunt auctor Christophoro a Costa, Medico et Cheirurgo" in "Caroli Clusii Exoticorum Libri Decem." (1605.)

The fame of the Sea Cocoa-nut was so great in the 16th century that it found a place in Camoens' famous epic (X 136).

"Nas ilhas da Maldiva nace a pranta
No profundo das aguas soberana
Cujo pomo contra o veneno urgente
He tido por antidoto excellente."

"O'er lone Maldivia's islets grows the plant,
Beneath profoundest seas, of sovereign might,
Whose pome of ev'ry Theriack is confest
By cunning leech of antidotes the best." (Burton).

Another account of the Sea Cocoa-nut and a description of the Maldive Islands we find in the "Itinerario" of John Huyghen Van Linschoten (1596), who had spent five years (1584-89) in Goa and had seen a great part of Eastern Asia. The following quotation is taken from the edition of the "Hakluyt Society"[1]: "Right over against the Cape of Comoriin, 60 miles into the sea westward, the Ilands called Maldyva doe begin, and from this cape on the north syde they lie under 7 degrées, and so reach south southeast, till they come under 3 degrées on the south syde, which is 140 myles. Some say there are 11,000 islands, but it is not certainely knowne, they can not be numbred. The Inhabitants are like the Malabares: some of these Ilands are inhabited, and some not inhabited, for they are very lowe, like the countrie of Cochin, Cranganor, etc., and some of them are so lowe, that they are commonlie covered with the sea: the Malabares say, that those Ilands in time past did ioyne fast unto the firme land of Malabar, and that the Sea in processe of tyme hath eaten them away. There is no merchandize to be had in them, but only coquen, which are Indian nuttes, and cayro, which are the shelles of the same nuts, and that is the Indian hemp, wherof they make ropes, cables, and other such like. . . . . There are some of these nuttes in the said Iland that are more estéemed then all the nuttes in India, for that they are good against all poyson, which are verie faire and great, and blackish: I saw some that were presented unto the viceroy of India, as great as a vessell of 2 cãnes measure, and cost above 300 Pardawen, which were to send unto the King of Spaine. Of this trée and her fruites, together with the usage thereof I will discourse more at large in the declaring of the Indian trées and fruites."

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[1] The Voyage of John Hughen Van Linschoten to the East Indies. From the old English translation of 1598. The First Book containing his description of the East in two volumes. Vol. I. 74-76. London 1885.

Linschoten was born at Haarlem (Holland) about the year 1563 and died on the 8th February 1611.

We are looking in vain for a more detailed description of the fruit in the II volume of the Itinerario, where a great number of plants are described[1].

The best account of the Maldives is that by François Pyrard[2] who was shipwrecked there in 1601. His description contains also the following short note on the Double Cocoa-nut: "The king has, besides his revenues, certain rights, *e.g.*, everything that is found on the seashore belongs to the king, and nobody has the courage to touch anything of the kind in order to keep it, but all must bring what they find to the king, whether it be a piece of a wrecked ship, pieces of wood, a box or other things carried to the shore. The same obtains with regard to a certain nut which is sometimes washed ashore. It has the size of a man's head and can be compared with two large melons grown together. People call it Tavarcarre and they believe that it comes from a tree growing at the bottom of the sea. The Portuguese call it ' Cocos des Maldives '. It has medicinal properties and carries a high prize. Very often, on account of this Tavarcarre, the servants and officers of the king maltreat a poor man if he is suspected of having found such a nut ; if somebody wants to take revenge on his neighbour he accuses him of having a nut in his possession, in order that his house may be searched, and if somebody becomes rich on a sudden and within a short time, people begin to say that he found a Tavarcarre, as if this were a great treasure."

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[1] Gulielmus Piso was so much disappointed at not finding the description promised by Linschoten that he wrote: "Promittens Nucis medicæ arborem integra historia enarrare, in quo tamen velut corvos hiantes nos eludit, vulgarem vero pertractare decurrit subsidiis in hanc mentem non excussus." Mantissa Aromatica in Clusius, l. c. p. 215.

[2] Pyrard was born at Laval towards 1575, travelled in the East Indies, was shipwrecked near the Maldives, fell into the hands of a Prince in Bengal, served two years in the Portuguese Army, and published on his return to France his "Discours du voyage des Français aux Indes Orientales," Paris, 1611. A better edition by Bignon and Bergeron appeared in 1615 under the title: "Voyages des Français aux Indes Orientales, Maldives, Moluques, et au Brasil, de 1601 à 1611.—We quote from the edition of 1679, Paris.

More credulous than Clusius and D'Orta as regards the wonderful properties of the Sea Cocoa-nut is William Piso, a Dutch physician, who had travelled in Brasil between 1636 and 1641, and who, by his writings added considerably to the scientific knowledge of the West Indies. He devotes a whole chapter written in elegant Latin to the "Nux Medica Maldivensium,"[1]. He first of all excuses himself, because he gives the figure of the fruit only instead of the whole plant; but nobody, he says, can expect the illustration of a plant which has been devoured by the sea and is now growing at a depth of 16 fathoms. The introduction to the chapter gives a vivid idea of the high esteem in which the Sea Cocoa-nut was held in former centuries, and, at the same time, of the way in which scientific subjects were treated 300 years ago. It runs as follows: "Amongst the immense benefits which the Divine Providence has showered upon mankind during the last centuries, one of the most valuable is the discovery of so many medicaments destined for the protection of the human race, because, after the welfare of the soul, the health of the human body takes the first place. With regard to the invention of iron machines, of which our present age is boasting so much, I should rather say that they are for the ruin of the nations than for their welfare. Also the art of printing though it may be specially fit for the preservation of literary monuments, only favours the bad zeal (kakozelia) of unable scribblers. Similarly, there is no reason why we should be proud of the booty of the Aerythraean Sea or of the gold mines of the Atlantis. because, according to the highminded poet the yellow metal is more dangerous than the iron.

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[1] Gulielmi Pisonis Mantissa Aromatica sive de Aromatum cardinalibus quatuor, et Plantis aliquot Indicis in Medicinam receptis, relatio nova. Caput XIX.

Jamque nocens ferrum, ferroque nocentius aurum
Prodierat; prodit bellum, quod pugnat utroque.
(Ovidius Metamorphosios primo.)

But the glory of the European Argonauts can never be too loudly sung; they have discovered a new continent which was hidden for centuries, they have unveiled the secrets of the sea and shown the way to so many islands scattered in the Indian Ocean. By their efforts it came about that almost

——Omnis ferat omnia tellus,

and that foreign medicaments of high and rare value were introduced into our country. Amongst them the Sea Cocoa-nut (Nux Medica Maldivensis) occupies the first and foremost rank, whether we consider its rareness or its prize and value, or finally its usefulness that was ever praised."

As to the origin of the nut Piso gives two opinions. The common people say that it grows on trees that are hidden in the sea. or which were covered with water at the time of an inundation. or that had their roots in the water as their natural medium. The more devout hold a different view. They believe that the nut grows on an island called Pallays, which is invisible to those who want to find it. and visible to others that do not know about it. From that island the nuts are carried away by the ocean-currents and washed upon the shores of the Maldives. The inhabitants of the Maldive Islands believe that Pallays is the happiest of all the countries of the world. and that the devils and malicious genii want to hide it before the eyes of man.

Piso relates that Rudolf II, Emperor of Germany, offered 4,000 florins for a Sea Cocoa-nut, but the family Wolfered in whose possession the nut was, was not inclined to part with it. In the Maldivian Islands the value of one nut was estimated at from 60-120 crowns; but those which measured as much in breadth as in length were the most esteemed; and those which attained a foot in diameter, were sold for 150 crowns; some kings have even been so greedy of obtaining these fruits as to have given a loaded ship for a single one.

We can easily understand the great desire of many of becoming the happy owner of such a nut, if we read the long catalogue of cases drawn up by Piso, in which the Nux Medica is said to have played such an important part in the restoration of the diseased to their former health. We cannot refrain from reproducing in this place for the benefit of the "sons of Æsculapius" at least two of the many medical prescriptions which were believed in and followed in the 16th and 17th centuries:

In Peste et Febribus malignis Contagiosis.

Cocci Maldivensis ʒj. Seminis Acetosæ mundati ℈j. Syrupi e succo Granatorum acidorum, aut Scabiosæ. aut florum Tunicæ ℥j. Diascordii Fracastorii ʒj. Decocti radicum Petasitidis, Scordii et Scorzoneræ. aut aquarum Boraginis, Buglossæ, q. s. F. Potio.

In Dysenteria cruenta, et Torminibus: facta ante praeparatione debita per Rheum et Clysteres.

Corticis intermedii Nucis Medicæ ʒj (si desit, Medulla aut Putamen vicem suppleat). Terræ Lemniæ, Lapidis Bezoartici Orientalis et Bistortæ radicis ana ʒj. Syr. de succo Portulacæ parum, ad consistentiam, Bol. F et insuper adjectis requisitis, Conditum, Potio,, et similia.

The most complete historical account of the Sea Cocoa-nut we find in Rumphius (Herbarium Amboinense, VI, 210) who describes the marvellous fruit under the Dutch name "Calappa Laut." The stories are fabulous enough, but in addition to it he tells us, that many other tales were related to him respecting it, too absurd to be repeated. The Malay and Chinese sailors used to affirm that it was born upon a tree deep under water, which was similar to the Cocoa-nut tree, and was visible in placid bays, upon the coast of Sumatra, but that if they sought to dive after the tree, it instantly disappeared. The Negro priests declared it grew near the island of Java, where its leaves and branches rose above the water, and in which a monstrous bird, or griffin, had its habitation, whence it used to sally forth nightly, and tear to pieces elephants, tigers, and rhinoceroces with its beak, the flesh of which it carried to its nest. Furthermore they avouched that ships were attracted by the waves which surrounded this tree, and there retained, the mariners falling a prey to this savage bird, so that the inhabitants of the Indian Archipelago always carefully avoided that spot. Rumphius thinks that the Chinese as well as the natives of the Archipelago have set, perhaps too high a value upon the medical properties of the nut, considering it an antidote to all poisons. The principal virtue resided in the meat or albumen, which lines the nut, and which is so hard and corneous, as to be preserved for a length of time after the embryo is destroyed. This substance was triturated with water in vessels of porphyry, and, mingled with black and white, or red coral, ebony, and stags' horns, was all drunk together. The great men formed of the shell, which possesses fewer medicinal properties, precious vessels, cutting off a transverse slice, which constitutes the lid; in this they put their tobacco, betel, lime, and whatever else they masticate, believing they can never then be contaminated by anything noxious.[1]

With the discovery of the Seychelles in 1743, a new period began for the Sea Cocoa-nut, the object of so many legends and superstitions. La Bourdonnais[2] was the first to discover the tree on one of the Seychelles Islands. He called it "Isle of Palms," now known by the name of "Praslin" Later on the tree was also found on Curieuse and Round Island. These are within half a mile of each other, mountainous and rocky. Plant, the well known explorer of Port Natal, tells us in what surroundings this noble palm is growing: "In the Seychelles," he says, "I more nearly realized my preconceived ideas of tropical vegetation than at any other place;—the beach fringed with common Cocoa-nuts; the ravines and watercourses overhung with Bananas, Bamboos, the open ground full of Pineapples—miles of them run wild; the tops of the mountains covered with forests of Ebony and Rosewood, interspersed with Tree-ferns of some 20-30 feet high, and then these glorious Lodoiceæ, with their leaves of fifteen to twenty feet span, and trunks reaching to the sky; to say nothing of groves of Cinnamon and Cloves and Bread-fruit, all new to me in this their natural wildness and beauty." Harrison is not less enthusiastic when he remarks: "To behold these trees growing in thousands, close to each other, the sexes intermingled; a numerous offspring starting up on all sides, sheltered by the parent plants;—the old ones fallen into the sear and yellow leaf, and going fast to decay, to make room for the young trees, presents to the eye a picture so mild and pleasing that it is difficult not to look upon them as animated subjects, capable of enjoyment, and sensible of their condition."

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[1] G. Curtis, Botanical Magazine, 2734-38.

[2] Mahé de la Bourdonnais, born in 1699, died in 1753.

Although the tree had been discovered at last, it still took a long time before it was accurately described. Pierre Sonnerat[1] gave a description of it, though not a very scientific one, when on his tour to New Guinea he landed upon the Isle des Palmiers (Praslin). He was the first to introduce the tree into the Isle of France.

The description given by Rochon[2] does not add any new information. It is, however, interesting to hear, that it was not uncommon as late as 1759 to see the nuts sold for upwards of four hundred pounds sterling each.

After this several botanists described the palm under different names : Gmelin called it Cocos maldivica[3], Giseke, Borassus sonnerati[4] , Commerson Lodoicea Callipyge and Cocos maritima[5]. Persoon, Lodoicea maldivica[6]. At last La Billardière was able to give a botanical description of it under its present name Lodoicea sechellarum[7], to which he added figures from specimens preserved in spirits, together with a representation of the tree from a drawing made in the Seychelles Islands by M. Lilet. The description is followed by an account of the uses of the Palm, communicated to the Museum of Natural History at Paris, by M. Quéau-Quincy, Correspondant et Administrateur Général des Isles Seychelles. The description, however, was still deficient in many points, and it was to be expected that a botanist like W. J. Hooker could find no rest before he had found out everything about that interesting tree. "These accounts [of La Billardière]" he writes in 1827 "in conjunction with some nuts that Mr. Barclay and myself received from our inestimable friend and correspondent, Charles Telfair, Esq. of the Mauritius, only served to stimulate our curiosity; and we requested Mr. Telfair, to procure, if possible, either from the Palms that he informed us were cultivated in the Isle of France, or from the Seychelles Islands, such specimens as would enable us to publish more satisfactory delineations than had yet appeared. The Isle of France Palms had not yet fructified; but Mr. Telfair lost no time in begging his friend J. Harrison, Esq., of the Seychelles, to obtain the necessary specimens. With the utmost promptitude and kindness that gentleman devoted several days to visiting, with a dozen of blacks, the Isles of Praslin and Curieuse; and in the midst of those little known islands, he not only made drawings from the living trees, but procured and forwarded to us, through Mr. Telfair, the male and female spadices and fruit, in different states, preserved in spirits, with leaves, a seedling plant, and even a portion of the trunk. All these, except the fully ripened fruit, arrived in safety. A perfect representation, therefore, of the mature nut, is still wanting"

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[1] P. Sonnerat, Voyage à la Nouv. Guinée, Paris 1776, I. p. 5-10, t. 3-7. Sonnerat born towards 1745, died in 1814, spent the greatest part of his life in travels and scientific observations.

[2] A. M. Rochon, Voyage à Madgascar, II. 146.

Cf. also Bory de Saint-Vincent, Voyage dans les iles d' Afrique, III. 156,246.

[3] Gmelin, J. F. Systema Naturæ, II., p. 569.

Cf. also Willdenow, Species Plantarum IV. p. 402, n. 6.

[4] Giseke, Lin. Prael. Ord. nat., p. 86

[5] Commerson Ms II. and Palmarium Vol. t. 1-15.

[6] Persoon, C. H. Enchir II., p 630.

La Billardière in Annales du Mus. d' Hist. Nat. IX. p. 140, t. 13.

Cf. also Sprengel, Systema Vegetabilium II., p. 622.

This want has been supplied, in the meantime, by various botanists, and the once so mysterious Sea Cocoa-nut tree is as well known as any other palm. We are not going to give a detailed description of the tree, as we are only concerned with its history, but we must mention a few points of interest regarding its life-history and economic uses.

This magnificent palm requires a great length of time to arrive at maturity. The shortest period before it puts forth its flower-buds is 30 years, and 130 years elapse before it attains its full growth. From the age of 15-25 years it is in its greatest beauty, the leaves at this period being much larger than they are later on. The stem grows quite upright, straight as an iron pillar, and in the male trees frequently attains a hundred feet in height, the females being shorter. At the age of 30 it first puts forth its blossoms, the males forming enormous catkins about 3 feet in length, and 3 inches in diameter, while the females are set on a strong zigzag stalk, from which hang four or five, or sometimes as many as eleven nuts, averaging about 40 lbs. weight each. From the time of flowering to the maturation of the fruit, a period of nearly 10 years elapses, the full size, however, being attained in about 4 years, at which time it is soft and full of a semi-transparent jelly-like substance. The arrangements provided by nature for the roots of this tree, are of a most peculiar kind. The base of the stem is rounded, and fits into a natural bowl or socket about $2\frac{1}{2}$ feet in diameter and 18 inches in depth. This bowl is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots penetrate the ground on all sides, never however becoming attached to the bowl, their partial elasticity affording an almost imperceptible but very necessary "play" to the parent stem when struggling against the force of violent gales. This bowl is of the same substance as the shell of the nut, only much thicker; it rots very slowly, for it has been found quite perfect and entire in every respect 60 years after the tree has been cut down.

The crown of the trunk, *i.e.*, the heart of the leaves is eaten like that of the American Cabbage Palm (Oreodoxa regia), and often preserved in vinegar; but it is less delicate and slightly bitter. The trunk itself after being split and cleared of its soft and fibrous part within, serves to make water troughs, as well as palisades for surrounding houses and gardens. The foliage is employed to thatch the roofs of houses and sheds, and even for the walls. With a hundred leaves a commodious dwelling may be constructed, including even the partitions of the apartments, the doors and windows. The down which is attached to the young leaves serves for filling mattrasses and pillows. Of the ribs of the leaves and fibres of the petiole they make baskets and brooms. The young foliage affords an excellent material for huts: for this purpose, the unexpanded leaves only are taken, dried in the sun, and cut into longitudinal strips, 2 or 3 lines in breadth, which are then plaited. Of the nut are made vessels of different forms and uses. When preserved whole and perforated in one or two places the shell serves to carry water. Plates, dishes, and drinking cups made of the nuts are valuable from their great strength and durability, so that this kind of utensil, in the Seychelles Islands, bears the name of "Vaiselle de l'Isle Praslin." Amongst other articles, shaving dishes, black, beautifully polished, set in silver and carved, are made from them.[1]

The marvellous medicinal properties which were ascribed to the nuts by ancient physicians, both European and Asiatic, have been recognized as fanciful nowadays and dependent solely on the rarity of the fruit. It is consequently no longer valued by Europeans but it is (according to Dymock) still in great repute among the Arabs and natives of India as a tonic, preservative, and alexipharmic. Ainslie relates that in his time the Vytians occasionally prescribed the kernel given in woman's milk, in cases of typhus fever, the dose being "a quarter of a pagoda weight twice daily," and adds, 'it is also reputed antiscorbutic and antivenereal." Dymock mentions that in Bombay it is prescribed as a tonic and febrifuge in combination with Lignum colubrinum (the small branches of Strychnos colubrina, L.). It is also believed to possess several other properties. "Daryali-naryal" says S. A. Ravat, "is corrupted in Bombay into Jehari-naryal which means 'poisonous Cocoa-nut,' and it is believed to be so by the common people. It is, however, non-poisonous, and is commonly given to children, mixed with the root of Nux vomica, for colic. It seems to act mechanically, like Bismuth." Rubbed up with water, it is given by natives to check diarrhœa and vomiting, especially in cholera. Some believe that the water of the green fruit or its soft kernel is antibilious and antacid when taken after meals.[1]

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[1] *Cf* Hooker, l. c.

It is to be regretted that the tree is not cultivated, and that a practice has prevailed of cutting it down in order to get at the fruit and tender leaves, and it is to be feared that this will lead to the extinction of the Sea Cocoa-nut, which will become in reality as rare as it was supposed to be by the travellers who picked up the first known specimens of its nuts floating on the sea.

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[1] *Cf.* Watt. Dict. of Econ. Prod. of India, Vol. V. 88.

A FIRST LIST OF MOSSES FROM WESTERN INDIA.

BY

L. J. SEDGWICK, I.C.S.

During the last two years the writer has been sending to England packets of specimens, which have in every case been indentified by Mr. H. N. Dixon, F.L.S., the well known English Bryologist. Where necessary the latter has consulted various continental authorities, especially Dr. Brotherus, and M. Cardot, and with the first two has named some new species. There still remain some undetermined, and apparently new, species sent from Mahableshwar in February last, but they will be included, it is hoped, in a later list in this journal. Besides the specimens collected by the writer there are four gathered by Mr. R. M. Maxwell, I.C.S., in Kanara, a number of specimens gathered by Lt.-Col. K. R. Kirtikar, F.L.S., I.M.S. (retd.), at various times during the last few years, and sent to the writer, and a few gathered by Prof. Woodrow about 1895, and sent by Col. Kirtikar with his own.

Very little can be done in the way of identifying Indian mosses in this country owing to the absence of literature, or type collections. The only works dealing with Indian Bryology are (1) Mitten's Musci Indiæ Orientalis, written in Latin and published by the Linnean Society in 1859, (2) Thwaites and Mitten's Mosses of Ceylon, (3) Contributions to the Bryological Flora of the N.-W. Himalayas by V. F. Brotherus, in the Acta Societatis Scientiarum Fenica, Helsingfors, 1898, (4) Contributions to the Bryological Flora of S. India by the same author, in Records of the Bot. Survey of India, Vol. I., No. 12, Calcutta, 1899. The first two are quite out of date, but the last two might prove of considerable use. The mosses from S. India described by Brotherus were collected by Dr. Walker in Coorg and Ceylon, and as Mr. Dixon says (in an article on the earlier gatherings of the present writer in the J. of B. for May), the mosses sent so far "naturally exhibit a close relationship with these (*i.e.*, the Coorg mosses) as well as with those of the Nilgiri Hills, and also, like them, indicate a very promising bryological field of study." Those sent by Col. Kirtikar as well as those representing the earlier collection of Prof. Woodrow are mainly duplicates of specimens collected by the writer, but the Kanara flora gives promise of an entirely different type. This is no doubt due to the fact that in that district both the mountains and the jungle approach much closer to the coast so that the influence of sea breezes is combined with the high altitudes and heavy rainfall of the whole mountain system of the Western Ghats.

The thanks of the present writer are due to Mr. Dixon, and also to Mr. G. B. Savery of Exeter, without whose assistance no headway could have been made with the study of these most facinating plants.

In the list below the new species are marked with* and those the fruit of which was new with†

Pogonatum aloides, P. Beauv.

c. fr., Mahableswar, on banks, Wood., Sedg.

This is the large oriental form mentioned in Dr. Braithwaite's British Moss Flora.

Campylopus aureus, v. d. B. & Lac.

Sterile. on the ground, Mahableshwar, Wood., Sedg.

Octoblepharum albidum, Hedw.

c. fr., Ratnagiri, Wood. Matheran, Kirt. On a toddy palm. Khairne, Thana District, Sedg.

† *Fissidens splachnobryoides*, Broth.

Sterile, Thana, Sedg. c. fr. on stones at Trimbakeshwar, Nasik District, Sedg.

The fruit was previouly unknown, and was described from the Trimbak specimen by Mr. Dixon in J. of B., Vol. 47. May 1909.

Fissidens (Semilimbidium) Walkeri, Broth.

On an earth bank in the Krishna R., Walva, Satara District, c. fr. Sedg. On an earth bank in a torrent course, Waishakhare, Thana District, Sedg.

In both these cases the bank on which the moss was growing is submerged in the rains, and it is probable that the moss will be found to be common in such places.

Fissidens crenulatus, Mitt.

c. fr., on earth banks, Mahableshwar, Sedg.

Anœctangium Walkeri, Broth.

On stones, Panchgani, sterile, Sedg.

Hymenostomum edentulum (Mitt.), Besch.

c. fr. on stones, Panchgani, Sedg.

Hyophila cylindrica. Hook.

Sterile and c. fr. (v. common) "Poona," Wood. Bandra, Lonavla, Mahableshwar, Kirt. Mahableshwar, Panchgani, Trimbakeshwar, Sedg.

Barbula consanguinea, Thw. & Mitt.

Sterile, on tiles in the Ganeshkhind Botanical Gardens, Sedg.

Calymperes Fordii, Besch.

Sterile, on tree trunks. Andheri, Sedg.

Pottia vernicosa, Hampe.

c. fr. on a wall, Thana, Sedg.

Macromitrium sulcatum, Brid.

Sterile, Kanara, Max. "Poona", Wood. Matheran and Mahableshwar, Kirt. On trees, v. common, Mahableshwar and Panchgani, Sedg. Often c. fr.

Trichostomum stenophyllum, Mitt.

c. fr. on trees, Mahableshwar, Sedg.

Splachnobryum indicum, Hampe & C. M.

c. fr. on flower-pots, Thana, Sedg.

Funaria hygrometrica, Sibth.

c. fr. v. common, "Poona", Wood. Mahableshwar, Kirt. Lonavla, Mahableshwar, always on sunny walls, Sedg.

Some of the gatherings approach the forms which have been called *F. leptoda*, Griff, and *F. nepalense*, C. M., but these are probably inconstant and local variations from the type.

**Brachymenium Turgidum*, Broth.

(Dixon in Revue Bryologique 35e annee, 1908, No. 4, p. 94.)

c. fr. n. sp. type described from a gathering from timber of a small bridge, Lonavla. Also on branches of an Euphorbia, same place, and on trees, Lonavla and Trimbakeshwar, all Sedg.; also Lonavla and Matheran, Kirt.

Brachymenium nepalense, Hook.

c. fr. on walls, Lonavla, Sedg.

Brachymenium walkeri, Broth.

c. fr. on stones, Panchgani, Sedg.

Anomobryum cymbifolium, Broth.

(*Bryum filiforme*, Mitt.)

Sterile, on stones and trees, Mahableshwar, Panchgani, Lonavla, Trimbakeshwar, Sedg.

Bryum coronatum, Schwaeg.

c. fr. v. common, on walls, almost everywhere, Sedg. "Poona" (1895) Wood.

Bryum strigosum, Wils.

(*B. Wightii*, Mitt.)

Sterile, Mahableshwar, Wood., Kirt., Sedg.

* *Bryum Ghatense*, Broth. & Dixon (not yet described).

c. fr. Lonavla, on a small bridge, and at Mahableshwar on a small bridge, Apparently always in sunny places and associated with *Funaria hygrometrica.*

A new species of the Areodyctyon group of Bryums, with lax rhomboidal cells, and stout wine-red nerves, and a small upright, club-shaped capsule.

Philonotis revoluta, v. d. B. & Lac.

Common, always sterile. Mahableshwar, Kirt. and Sedg. Lonavla, Panchgani and Trimbakeshwar, Sedg.

Erpodium mangiferæ, C. M.

Sterile. On the bark of a jackfruit tree, Ghatkopar, Sedg.

Mr. Dixon in a long note in the J. of B. loc. cit. expresses as his opinion based on a study of this specimen together with those of *E. mangiferæ* and *E. bellii*, Mitt., in Mitten's own herbarium, and at the British Museum, that the two specimens must be united..

* *Pteryobryopsis Maxwellii*, Cardot & Dixon.

n. sp. (Dixon in J. of B. loc. cit. p. 160).

On trees and rocks, Kanara, c. fr., Maxwell, after whom it is named. On trees, Mahableshwar, Sedg.

Pterobryopsis Walkeri, Broth.

On stones, Kanara, Maxwell. On trees, Mahableshwar, Sedg. Fruit unknown.

(First described as a new species sub nom. P. Kanarense by H. N. Dixon, loc. cit., p. 163, but now referred to *P. Walkeri.*)

Trichostelium monostichum, Thw. & Mitt.

c. fr., on tree roots, Mahableshwar, Sedg.

Symphysodon angustatus, (C. M.) Jaeg.

c. fr., on trees, Mahableshwar, Sedg.

Trachopodiopsis blanda, (Mitt.) Fleisch.

On trees, common, "Poona" (1895), Wood. Matheran and Mahableshwar, Kirt. Lonavla, Trimbakeshwar, Mahableshwar, Sedg. Always c. fr.

Meteoriopsis squarrosa, (Hook.) Fleisch.

Sterile, on trees, Mahableshwar, Kirt. & Sedg.

Levierella fabroniacea, C. M.

c. fr., on trees, Trimbakeshwar, Sedg.

Stereophyllum tavoyense, (Hook.) Jaeg.

c. fr., on a tree, Wasind, Thana District, Sedg.

† *Pinnatella calcuttensis*, (C. M.) Fleisch.

Sterile, Mahableshwar, Kirt. c. fr., Mahableshwar, Sedg. The fruit is new and has not yet been described. It does not fruit freely, and the fruit is brittle, the capsules being small for so large a moss, cup-shaped, of a fuscous colour, and produce from irregular positions on the branches on setas about 3 or 4 lines long, which grow at right angles to the pendulous branches.

Neckera andamana, C. M.

On trees, Kanara, Max.

It is hoped to bring out a second list in the course of a few months. The writer would be most grateful for specimens from any part of India. Mosses are no trouble to collect, as they do not require pressing, mounting, or preserving in any way, and it does not matter in what manner or position they are packed.

PLANTS OF THE PUNJAB.

A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR.

BY

Lieut.-Colonel C. J. Bamber, F.L.S.,

Indian Medical Service.

Part V.

(Continued from page 721 of this Volume.)

Shrubs with Alternate Exstipulate Simple Leaves.

Petals Ununited.

Anona squamosa,
Custard Apple, Sharifa, Sitaphal.
Anonaceæ.
F. B. I. i. 78.
The Plains as far north as Gurdaspur (Watt)

large, nearly evergreen ; leaves 2-3 by ¾-1½ ins. oblong, blunt or long pointed, base narrowed, bluish green beneath, velvety when young, membranous, stalked ; flowers white, 1 in. long, solitary on short branchlets, sepals 3, small, triangular, united at the base, petals 3, outer 1 in. long, narrow-oblong, fleshy, inner 3 minute or wanting ; stamens many, style one; fruit 2-4 ins. across, yellowish green, fleshy, edible covered with a yellowish green skin, tubercled like crocodile skin, seeds many, oblong, brownish black, with a swelling at the notch. A native of the West Indies cultivated for its fruit.

Farsetia Jacquemontii,
Faridbuti, lathia.
Cruciferæ.
F. B. I. i. 140.
The Plains in sandy places, Sirsa.

small ; branches rigid, hoary, with hairs flattened to the twigs, twiggy ; leaves ¼-1 in., linear ; flowers large in spikes sepals 4, hairy, pointed, pouched at the base, petals 4, half as long again as the sepals with long stalks, stamens 6 : capsules 1½-2 ins. by ⅛-⅙ in. flattened, linear, sessile, valves flat, seeds nearly round, broadly winged, in two series.

Farsetia Hamiltonii,
Faridbuti.
Cruciferæ.
F. B. I. i. 140.
The Plains.
Shahpur (Douie).

small, branches more rigid and woody and more densely velvety than the last species, long, erect and twiggy ; leaves linear, very narrow, flowers small in long spicate racemes, sepals 4, hairy, blunt, margins thin, papery, petals 4, ovate with a broad tip, a little longer than the sepals long stalked, pink, stamens 6 ; capsules linear ½-1 by $\frac{1}{20}$ in., seeds as above but in one series.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Farsetia ægyptiaca, *Muli.* CRUCIFERÆ. F. B. I. i. 140. Salt range (Edgeworth). Choa Saidan Shah (Douie).	small, branches rigid, hoary, forked, twiggy ; leaves linear ; flowers in spikes, not close set, large, calyx cylindrical, sepals 4, blunt, $\frac{1}{4}$-$\frac{1}{3}$ in., hoary, petals 4, linear, blunt, twice as long as the sepals, stamens 6 ; capsules $\frac{1}{2}$-$\frac{3}{4}$ by $\frac{1}{8}$-$\frac{1}{4}$ in., broad, erect, seeds as above in two series.
Dipterygium glaucum, CRUCIFERÆ. F. B. I. i. 164. The Plains. Multan (Edgeworth).	small, branches many, widely separating ; smooth or leaves and stem slightly rough with sticky glands ; leaves $\frac{1}{6}$ $\frac{1}{2}$ in. long, ovate oblong, shortly stalked ; flowers small, few in bracteate racemes, sepals short, 4, petals 4, stamens 6, free, capsules $\frac{1}{6}$ in., drooping, wrinkled transversely, seed solitary, winged.
Physorhyncus brahvicus, CRUCIFERÆ. F. B. I. i. 165. Salt range (Vicary).	small, smooth, leafy ; leaves fleshy, 1-4 ins., ovate oblong, lower stalked, upper linear-lanceolate, narrowed at the base, running down the stem slightly, with earshaped lobes, flowers large, white in long racemes, sepals 4, erect, petals 4, stamens 6 ; capsules two jointed $\frac{1}{2}$-$\frac{3}{4}$ in. long, lower joint seedless, upper large, ovoid, 2-celled, cells 2-4-seeded with long conical beak, seeds flattened.
Xylosma longifolium,	see Trees, Alternate, Exstipulate, Simple.
Tamarix gallica, **Tamarisk,** *Jhau, pilchi, lai.* TAMARISCINEÆ. F. B. I. i. 248. The Plains. Delhi, Lahore.	large, branches slender jointed leaves minute, scale like not sheathing, overlapping at first, distant later, usually green ; flowers $\frac{1}{8}$ in. diam., shortly stalked, crowded in long slender spiked branched racemes, white or pink, bracts shorter than the flowers, half sheathing, membranous, short-pointed, sepals persistent, triangular, blunt ; petals longer than the sepals, stamens 5, styles 3 ; capsules $\frac{1}{4}$ in. long, narrowed from an ovoid base.
Tamarix salina, *Kwa.* TAMARISCINEÆ. F. B. I. i. 248. North-Western Frontier Province. Esakheyl.	medium size, smooth, bluish green ; leaves minute, scale-like, heart shaped, somewhat sheathing, bracts equalling the flowers in length, linear, stigmas sessile, in other respects like the last species.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Tamarix dioica,
Kao'lei, panch pilchi.
TAMARISCINEÆ.
F. B I. i. 249.
The Plains.

small, branches long drooping ; leaves minute, scale-like, sheathing, greyish green with a broad white margin, smooth, long-pointed ; flowers in two sexes, purple pink in rather short compact stalked spikes, bracts nearly as long as the flowers, triangular, long pointed, reddish brown, stamens 10, styles 3 ; capsule oblong, tapering, twice as long as the withered sepals and petals.

Myricaria germanica,
Ghaz.
TAMARISCINEÆ.
F. B. I. i. 250.
Hazara, 7-8,000 ft.
(Barrett).

medium size, branches many, parallel to the stem, stem slender, with fine parallel lines, with blueish green waxy gloss when young ; leaves small, linear-lanceolate, flowers small, pink-purple, on short stalks in lateral or terminal spike-like racemes, 1-18 ins. long, bracts ovate-lanceolate, three to four times as long as the short flower stalks, with broad thin margins, sepals 5, ununited, lanceolate, equal in length to the petals, petals 5, stamens 10, alternately long and short, united for half their length, stigmas 3, sessile ; seeds many, with a tuft of hairs, usually stalked.

Skimmia laureola,
Ner, burru.
RUTACEÆ.
F. B. I. i. 499.
Himalaya, 6-10,000 ft.
Simla, Mahasu (Collett).
Murree, Hazara (Barrett).

small, strongly aromatic, evergreen ; bark white, stringy ; leaves oblong lanceolate, 3-6 ins. long, smooth, gland-dotted, shining, crowded at the end of branches; flowers male and female $\frac{1}{2}$ in. diam., white or yellow, in crowded erect terminal branching racemes $1\frac{1}{2}$-2 ins. long, calyx persistent, 5-lobed, petals 4-5, oblong, much longer than the calyx, stamens 4-5, imperfect in female flowers, stigma 2-5 lobed ; drupe red, ovoid $\frac{1}{2}$-$\frac{3}{4}$ in. long, with 2-5 one-seeded stones.

Citrus medica,
Lemon or Lime,
Nimbu.
RUTACEÆ.
F. B. I. i. 514.
The Plains.

large, bark greenish grey, smooth, long axillary spines ; leaves jointed to stalk, stalk often winged, 3-6 ins. by 1-$2\frac{1}{2}$ ins., ovate lanceolate, smooth, leathery ; flowers white, sweet-scented, solitary or in axillary clusters, $\frac{1}{2}$-1 in. long, calyx cup-shaped, 3-5-toothed or entire, petals 4-8, often tinged with pink, oblong, fleshy, gland-dotted, stamens 20-40 ; fruit 2-4 ins. long, ovoid oblong or round, rind thick or thin, yellow when ripe, pulp cellular and juicy, usually acid.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Olax nana, OLACINEÆ. F. B. I. i. 576. Himalaya to 5,000 ft.	small, dwarfed by jungle fires, root stock woody with annual ribbed shoots 2 ft. high ; leaves 1½-2½ by ¼-½ in., oblong-lanceolate, nearly sessile, smooth and light green above, greenish with a bloom beneath, margins turned back ; flowers nearly ½ in. across, solitary, calyx minute, increases in fruit, petals 3, oblong-lanceolate, stamens 3, staminodes 5-6, bifid, longer than the stamens ; fruit, the size of a pea, round, one-seeded.
Gymnosporia or Celastrus, Royleana or spinosa, *Gwala darim.* CELASTRINEÆ F. B. I. i. 620. Himalaya to 3,000 ft. Salt range. Hazara (Barrett).	medium size, smooth, densely branching, stiff, straight, axillary spines not bearing leaves ; leaves smooth, ovate or round, ¾-1½ ins. by ½-1 in., toothed ; flowers many, white in short axillary clusters, calyx five lobed, lobes obtuse, minutely fringed, petals 5, oblong, stamens 5 ; capsule three-angled, ¼ in. diam., cells three, seeds 3, half enclosed in a red fleshy outer coat.
Gymnosporia Wallichiana or Celastrus rigida, *Pataki.* CELASTRINEÆ. F. B. I. i. 621. North-West Frontier Province. Peshawar. Rawulpindi.	medium size, branches much zig-zagged, spines 1-3 ins. long, bearing leaves and flowers ; leaves 1-1½ by ¾-1 in., obovate, crenate, leathery, smooth ; flowers in clusters shorter than the leaves ; fruit somewhat inflated, three and one-seeded cells ; in other respects like the last species.
Gymnosporia or Celastrus montana, *Talkar, mareila, sherawane.* CELASTRINEÆ. F. B. I. i. 621. The Plains to 2,000 ft.	large, branches stiff and nearly straight, spines axillary, straight, 1-2 ins. long, often bearing leaves and flowers ; leaves 1-3 by ¼-2 ins., linear, ovate to roundly ovate, minutely toothed or not, leathery ; flowers, in axillary or on the spines, much branched clusters, shorter than the leaves, small, greenish white, bracts, calyx lobes and petals fringed ; fruit round or ovoid, black, size of a pea, 1-3 celled, cells one-seeded ; in other respects like the last species.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

Rhus Cotinus, **The wig tree,** **Venetian Sumach,** *Tunga, bhan, tung.* ANACARDIACEÆ. F. B. I. ii. 9. Himalaya, 3-5,000 ft. Hazara (Barrett). Valleys below Simla. (Collett).	large, bark reddish brown, branchlets red, young parts grey woolly ; leaves 2-4 by 1½-3 ins., stalks, 1½-3 ins. long, ovate or round, polished above, slightly woolly beneath ; flowers very small, pale yellow, $\frac{1}{10}$ in. diam. few on very slender long stalks forming loose feathery, pale, purple bunches, sepals linear, oblong, petals longer than the sepals, stamens 5, styles 3 ; drupe $\frac{1}{5}$ in. long, compressed reddish covered with white hairs. The wood under the name of Young Fustic is much used in Europe for dyeing wool scarlet or orange. The bark and leaves are used for tanning.
Crotolaria Burhia, *Khip, sis, karsan.* LEGUMINOSÆ. F. B. I. ii. 66. The Plains to 4,000 ft. Sargodha (Douie).	small, branches numerous, stiff, ending sometimes in spines with fine pale felt ; leaves few, scattered, almost sessile, ¼-1½ ins. long, silky, ovate or lanceolate ; flowers yellow 6-12 in terminal racemes flower stalks very short with two bracteoles, calyx densely silky, teeth lanceolate, corolla yellow with reddish veins, hardly protruding, stamens 10, united, style long, hairy above ; pod 3-4 seeded hardly longer than the calyx, oblong, hairy. The fibre is sometimes used in place of hemp.
Crotolaria albida, LEGUMINOSÆ. F. B. I. ii. 71. The Plains to 7,000 ft. Simla (Collett).	small, branches many, firm, round, slender, somewhat silky ; leaves nearly sessile, 1-2 ins. long, firm, gland-dotted, narrow, oblong, smooth above, silky beneath, flowers, ⅓ in. long, pale yellow, usually in terminal racemes calyx top-shaped, ¼ in. long, thinly silky, longer in fruit, teeth long, 3 lower linear, 2 upper broader and blunter ; corolla pale yellow, rarely tinged with lilac, hardly protruding, stamens 10 united, style long, hairy above ; pod ½-⅔ in. long, sessile, twice as long as the calyx, smooth, oblong, seeds 6-12.
Crotolaria juncea, *Sanai, arjha san.* LEGUMINOSÆ. F. B. I. ii. 79. The Plains.	medium size, cultivated ; branches stiff, slender, silky ; leaves at somewhat distant spaces linear or oblong, 1½-3 ins. long, both surfaces shining with short brown silky hairs, flowers 1 in. long in 12-20—flowered racemes, 6-12 ins. long, bracts minute, linear, calyx

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNUNITED.

½-¾ in. long, covered with rusty velvety hairs, teeth very deep, linear. corolla bright yellow, smooth, protruding a little out of the calyx, stamens 10, united, style long, hairy above; pod 1-1¼ ins. long, covered with silky hairs, seeds 10-15. The fibre is much used for making cordage and sacking.

Itea nutans,
Lelar gorkath.
SAXIFRAGACEÆ.
F. B. I. ii. 408.
Himalaya, 3-6,000 ft.
Sutlej Valley, Suni (Collett).

large, bark dark grey, leaves 4-6 by 1½-2½ ins., ovate oblong, long-pointed, glandular-toothed, leathery, dark green, shining above, leaf stalk 1-1¼ ins. long, stout; flowers white, ⅒ in. long, in clusters of 3-7 forming velvety, drooping racemes 4-8 ins. long, calyx velvety, tube bell-shaped, lobes 5, persistent, petals 5, twice the length of the calyx lobes, linear, erect, stamens 5; capsule ⅕ in. long, separating into 2 valves through the cell partition and the style, seeds many.

Osbeckia stellata,

see Shrubs, Opposite, Exstipulate, Simple.

Lagerstrœmia indica,

see Shrubs, Opposite, Exstipulate, Simple.

Opuntia Dillenii,
Prickly Pear,
Cactus,
Nagphana.
CACTACEÆ.
F. B. I. ii. 657.
The Plains to 7,000 ft.
Native of South America.

medium size, stem flat or round or angled, fleshy, armed with barbed bristles in clusters; leaves fleshy, soon falling off; flowers orange red, solitary, sessile, calyx lobes 3-many, small, overlapping, petals many, free or shortly united below, stamens many; fruit one celled, pulpy, seeds many, oblong or kidney shaped; coccus cacti, the cochineal insect lives on this plant—It is much used for hedges.

Andrachne cordifolia,
Kurkni, gurguli, bersu.
EUPHORBIACEÆ.
F. B. I. v. 283.
Himalaya, 5-8 000 ft.
Simla, Mashobra (Collett).
Chang agun (Douie).

small, branches slender, round, smooth; leaves long-stalked, 1-3½ by ½-1½ ins., thin, margin smooth, ovate oblong tip rounded, base rounded, stalk ¼-¾ in. long, flowers ⅙ in. diam. green on long, slender axillary stalks, the males in clusters females solitary, calyx 5 lobed petals 5, stamens 5, females without petals, styles 3, divided into 2 long branches; fruit ¼ in. diam, round with a depression above, seeds 6, triangular.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

FLOWERS MINUTE IN HEADS.

Vernonia cinerascens,
COMPOSITÆ.
F. B. I. iii 237.
The Plains.
The Salt range.
Waziristan, Baluchistan.

medium size, much branched, grey, velvety, branches grooved, white ; leaves ½-1½ ins., oblong, rounded tapering to a narrow base, often with an abrupt tip, sometimes toothed, gland-dotted, velvety on both surfaces ; flowers purple in solitary heads, ¼ in. diam., on the ends of the branches of flat-topped clusters, bracts round the heads, ⅛ in., in many series, linear, inner longest, calyx of hairs (pappus) ⅙ in., white, persistent, corollas smooth, slender, all tubular, teeth 5, narrow, anther bases blunt, style-arms long, hairy all round, short pointed ; achenes (seeds) 1/10 in., 5-ribbed, tapering to the base, covered with rather stiff hairs.

Pluchea ovalis,
COMPOSITÆ.
F. B. I. iii. 272.
The Salt range (Aitchison)

large, branches with broad green toothed wings ; leaves 2-.½ by ¾-1 in., sessile, oblong, coarsely toothed, tips rounded , flowers white yellow or lilac in heads in compound hairy terminal leafless flat clusters, heads ¼ in. diam., discoid, flowers all tubular, outer bracts of heads short-pointed, seeds small, 4-5-angled, smooth, tuft of hairs on top, slender,

Pluchea Wallichiana,
COMPOSITÆ.
F. B. I. iii. 272.
The Plains (Falconer and Stewart).

large, velvety with glands and hairy, branches not winged ; leaves 1-2 ins. long, sessile, oblong and ovate with broad tip, slightly toothed, rigid, nerves prominent above and below ; flowers white, yellow or lilac in heads in compound terminal flat leafless clusters, heads ¼ in. diam. ; flowers all tubular, outer bracts of heads woolly, somewhat pointed, seeds small, 4-5-angled, tuft of hairs, reddish.

Pluchea lanceolata,
Sermer, e-hami.
COMPOSITÆ
F. B. I. iii. 272.
The Plains.

small, greyish, hairy, velvety, branches slender ; leaves 1-2, oblong, sessile, narrowed to the base, margin smooth or toothed at the tip, nerves oblique, prominent on both surfaces ; flowers white yellow or lilac in heads in compound flat leafless clusters, heads ¼ in diam , longer than broad, bracts of heads short rounded blunt, outer ones with grey hairs. A weed of cultivation. The leaves are aperient and are used to adulterate senna.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

FLOWERS MINUTE IN HEADS.

Pluchea arguta,
COMPOSITÆ.
F. B. I. iii. 273.
The Plains (Aitchison).

medium size, branches, stout, velvety with glands; leaves 1-1½ by ⅙ ⅔ in., sessile, lanceolate or ovate with broad tips, coarsely toothed, base with ear shaped projections or not; flowers white, yellow or lilac in heads stalked solitary or few, hardly in clusters, heads ⅓-½ in. diam., bracts of heads narrow, sharp pointed, rigid.

Inula Cappa,
COMPOSITÆ.
F. B. I. iii. 295.
Himalaya, 4-6,000 ft.
Valleys below Simla (Collett).
Hazara (Barrett).

medium size, scented, branches thick, densely woolly as also are under surface of leaves and flower clusters, leaves 3-6 by 1-2½ ins., leathery, sessile or shortly stalked, toothed, silky velvety beneath, teeth close set; flowers all tubular or a few radiate, in many heads ⅓ in. diam., yellow, in rounded clusters, bracts round the heads linear stiff, sharp-pointed, outer ones shortest; seeds 1/20 in., silky, tufts of hairs (pappus) ⅙ in., grey, hairs thickened at the ends.

Inula cuspidata,
COMPOSITÆ.
F. B. I. iii. 296.
Himalaya, 4-7,000 ft.
Simla (Collett).

medium size, nearly smooth; branches slender; leaves 5 by 2 ins., stalked, ovate-lanceolate, thin, long pointed, young velvety, old rough above; flowers yellow, outer ones radiate, in many heads, ⅓ in. diam., on slender stalks crowded in broad terminal clusters, bracts of heads linear, sharp-pointed, stiff, seeds 1/16 in., tufts of hairs (pappus) ⅙ in., yellowish, hairs thickened at the tip.

Pulicaria crispa,

see Herbs, Erect, Alternate, Exstipulate, Simple, Toothed, Petals United.

Pulicaria glaucescens,

see Herbs, Erect, Alternate, Exstipulate, Simple, Toothed, Petals United.

FLOWERS NOT IN HEADS

Gaultheria nummularioides,

see Prostrate Shrubs, Alternate, Exstipulate, Simple.

Gaultheria tricophylla,

see Prostrate Shrubs, Alternate, Exstipulate, Simple.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

FLOWERS NOT IN HEADS.

Cassiope fastigiata,
ERICACEÆ.
F. B. I. iii. 459.
Himalaya, 10-14,000 ft.
Hattu (Collett).
Marali (Bamber).

small, dense tufts of parallel erect branches, 6-12 ins. high, leaves $\frac{1}{5}$ in. ovate oblong, overlapping, pressed against the branches, thickened on the back, hairy ; flowers white on solitary stalks or in twos or fours ; sepals $\frac{1}{8}$-$\frac{1}{6}$ in., short-pointed, nearly smooth, margins often toothed and membranous, corolla $\frac{1}{4}$-$\frac{1}{3}$ in., widely bell-shaped, fleshy ; capsule round, point depressed.

Rhododendron campanulatum,
Cherailu, sarngar, gaggaryurmi.
ERICACEÆ.
F. B. I. iii. 466.
Himalaya, 9-14,000 ft.
The Chor (Collett).
Marali (Bamber).

medium size, bark thin grey ; leaves 3-5 ins. long, oblong, rounded at both ends, crowded at the end of branches, leathery, dark green, smooth above, cinnamon felted beneath ; flowers mauve in large clusters, stalks as long as the corolla tube, bracts silky, calyx teeth broadly triangular, small, corolla bell-shaped, 1-1$\frac{1}{2}$ by $\frac{1}{2}$-1 in., lobes 5, stamens 10 ; capsule cylindrical, 1 in. long, curved ; seeds linear oblong, flattened. The powdered leaves are mixed with tobacco and used as snuff in colds.

Rhododendron lepidotum,
Ta isfur, taliori.
ERICACEÆ.
F. B. I. iii. 471.
Himalaya, 8-15,000 ft.
Simla, Jacko, Hattu (Collett).
Marali (Bamber).

small, scented, young parts covered with silvery and golden scales, branches rough ; leaves $\frac{3}{4}$-1 in. long, ovate with broad tips, base narrow, nearly sessile at the ends of branches, smooth above, silvery beneath ; flowers red, yellow or purple, solitary or 2-3 together, stalks $\frac{1}{2}$-1$\frac{1}{2}$ ins. long, very rough, calyx teeth oval, corolla tube short, lobes round, spreading $\frac{1}{5}$-$\frac{1}{6}$ in. long, stamens 8-10, hairy below ; capsule $\frac{1}{4}$-$\frac{1}{3}$ by $\frac{1}{6}$-$\frac{1}{4}$ in., erect. The smoke of the leaves is used in native medicine as a stimulant.

Rhododendron Anthopogon,
Nichni, kaizaban, tuzaktzun.
ERICACEÆ.
F. B. I. iii. 472.
Himalaya, 11-16,000 ft.
The Chor (Collett).
Marali (Bamber).

small, scented, branchlets rough and scaly ; leaves 1-1$\frac{1}{2}$ in. long, broad oblong, shining above, cinnamon felted beneath, stalk $\frac{1}{10}$-$\frac{1}{4}$ in. long ; flowers yellowish white in small terminal clusters, calyx teeth oblong, thin, margins hairy, corolla tubular, mouth dilated, tube $\frac{1}{5}$ in. long, lobes ovate with broad tips, spreading, stamens 6-8 ; capsule $\frac{1}{5}$ in. long, ovoid. The leaves are used for the same purpose as those of the last species.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Mœsa indica,	see Trees, Alternate, Exstipulate, Simple.
Myrsine africana, *Bebrang, kakhum, shamshad.* MYRSINEÆ. F. B. I. iii. 511. Salt Range. Himalaya, 1-8,500 ft. Simla (Collett). Murree (Douie).	small or large, branchlets rusty velvety ; leaves $\frac{1}{2}$-$1\frac{1}{2}$ ins. long, nearly sessile, lanceolate, gland dotted, sharply toothed ; flowers small, nearly sessile in clusters of 3-8, calyx 4-lobed, free, persistent, corolla 4-lobed, rotate, stamens 4, stigma rounded, style 2-4 branched ; berry $\frac{1}{6}$ in. dia., red, round, edible. The fruit is sold in bazaars as a strong purging vermifuge.
Myrsine semiserrata, *Parwana, gogsa, gaunta.* MYRSINEÆ. F. B. I. iii. 511. Himalaya 3-9,000 ft. Simla, The Glen (Collett).	large, bark ashy, smooth ; leaves 2-5 by $\frac{1}{2}$-$1\frac{1}{2}$ ins., smooth, leathery, lanceolate sharply toothed towards the tip, gland dotted, stalk $\frac{1}{10}$-$\frac{1}{4}$ in. long ; flowers in axillary clusters, stalks $\frac{1}{4}$ in. long, calyx and corolla 4—rarely 5-lobed, $\frac{1}{10}$ in. diam., stamens 4, rarely 5, style with 2-4 flat spreading branches, berry red, round $\frac{1}{6}$-$\frac{1}{5}$ in. diam.
Embelia robusta, *Bayabirang.* MYRSINEÆ. F. B. I. iii. 515. The Plains to 5,000 ft. Near the Jumna.	large, bark brown with horizontal cracks on the branches, and small warty excrescences ; leaves $3\frac{1}{2}$-7 by 2-$3\frac{1}{4}$ ins., oblong or lanceolate with broader tip, base narrowed, margin undulate, short-pointed, rusty velvety beneath, nerves prominent, stalk glandular, usually grooved ; flowers small in simple or clustered racemes of 1-2 ins. in length, calyx 5-lobed, persistent, petals 5, oblong, reflexed, stamens 5 on the petals, styles short persistent ; fruit a dry berry, red, round with ribs and crowned by the style ; seed usually one, round with a hollow base. The fruit is used for the same purpose as that of *Myrsine africana.*
Ardisia humilis, MYRSINEÆ. F. B. I. iii. 529. The Plains to 5,000 ft.	large, smooth, branched ; leaves 4-8 by $1\frac{1}{2}$-$3\frac{1}{2}$ ins., oblong or ovate with broad tip, short pointed, leathery, fleshy, margin smooth ; flowers pink, $\frac{1}{2}$ in. diam., in axillary clustered racemes, stalks 1-2 ins. long, bracts soon falling off, calyx lobes 5, blunt, oval, corolla 5-lobed, stamens 5 ; fruit round, black when ripe, size of a pea, crowned with the style, full of pink juice, seed one.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Roptonia buxifolia,
Gurgura.
MYRSINEÆ.
F. B. I. iii. 534.
Peshawar.
Salt Range.
Trans Indus Hills, 2-3,000 feet.

large, spinous or not; branches grey; leaves 1½ by ⅔ in., shortly stalked, ovate with a broad blunt tip, base narrowed, margin smooth, recurved, leathery, smooth above, slightly velvety beneath; flowers small, greenish yellow, sessile in axillary tufts, calyx lobes 5; round, overlapping, corolla tube short, lobes 5, oblong, blunt, stamens 5, alternating with 5 processes; fruit round, fleshy, edible, ¼-⅓ in. diam., one—or rarely two-seeded; seed round with hollowed base.

Rhazya stricta,
Vena, gandera, vargalam.
APOCYNACEÆ.
F. B. I. iii. 640.
Salt Range.
Peshawar.
Trans Indus Plains.

small, smooth, stout, series of stems in clumps, milky juice from young parts; leaves 3-4 by ½-¾ in., oblong-lanceolate, short-pointed, sessile, leathery and yellow when dry; flowers white, in dense terminal short axillary stoutly branched and shortly stalked clusters, bracts awl-like and persistent, calyx short, lobes 5, short pointed, corolla circular, tube cylindric ⅓ in., lobes 5, short, broad overlapping to the left, stamens 5, above the middle of corolla tube, but not protruding; follicles two, erect, 2-3 by ¼ in., slightly flattened, rather leathery, seeds ⅓ in. long angularly flattened, shortly winged. The leaves, flowers, and fruit are used in rheumatism and other joint affections, the dried fruit is used to coagulate milk.

Nerium odorum,
Oleander,
Kanér, ganhira.
APOCYNACEÆ.
F. B. I. iii. 654.
The Plains to 5,000 ft.
In dry ravines.
Hazara (Barrett).

medium size, bark silvery grey, from young parts a milky juice exudes; leaves in whorls of three, 4-6 by ½-1 in., linear lanceolate, thick, leathery, long pointed, dark green shining above, rough and dotted beneath, stalk short; flowers red, pink, or white, usually sweet scented, sometimes double, in large terminal branching clusters, sepals broad, awl-pointed, corolla 1½ ins. across, funnel shaped, lobes spreading, rounded overlapping to the left, tube ¾ in. long, 5 fringed scales on throat, stamens inserted near the mouth of the tube forming a cone, each prolonged up in a long thread-like hairy appendage; follicles narrow, 6-9 by ¼-⅓ in., straight, united below; seeds many, crowned with a tuft of hairs. The leaves are poisonous to all animals but goats. An oil extracted from the root bark is used in skin diseases, especially in

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

	leprosy. A yellow resin present in this plant is an active heart poison.
Ehretia obtusifolia, *Chamror, bari kunder, khabarra.* BORAGINACEÆ. F. B. I. iv. 142. Salt Range.	medium size ; leaves oblong ovate with broad blunt tip, 1-1⅔ ins. long, wedge shaped at the base ; flowers larger than *Ehretia lævis*, which see under Trees, Alternate, Exstipulate, Simple.
Heliotropium zeylanicum,	see Herbs, Erect, Alternate, Exstipulate, Simple, Entire.
Heliotropium dasycarpum,	see Herbs, Erect, Alternate, Exstipulate, Simple, Entire.
Heliotropium Eichwaldi,	see Herbs, Erect, Alternate, Exstipulate, Simple, Entire.
Breweria latifolia, CONVOLVULACEÆ. F. B. I. iv. 224. The Plains of the Western Punjab.	small, stiff, rough, much branched, densely silky ; leaves ¼-¾ in., oblong with rounded ends, margins entire ; flowers ¼ in. sessile, pinkish, 1-3 together, axillary, bracts small, calyx-lobes 5, long-pointed, very silky ; corolla funnel-shaped barely 5-lobed, folding at the angles, stamens 5 enclosed in the corolla-tube, styles 2 nearly ununited from the base ; capsule ⅖ in., ovoid, 4-seeded, seeds ovoid-oblong smooth.
Cressa cretica, CONVOLVULACEÆ. F. B. I. iv. 225. The Plains.	small, stem 6-18 ins. high ; leaves ¼-⅓ in. long, sessile, oblong, short pointed ; flowers small, in terminal spikes or clusters or sessile in the axils of upper leaves, sepals ⅛ in. long, equal, corolla ⅙ in. long, funnel-shaped, white or pink, lobes 5, reflexed, stamens 5, project beyond the corolla, styles 2, linear ; capsule 4 valved, seeds 4, smooth.
Solanum dulcamara, **Woody Nightshade,** *Ruba barik.* SOLANACEÆ. F. B. I. iv. 229. Himalaya, 4-8,000 ft. Narkunda (Collett).	small, branches long, trailing, smooth or velvety ; leaves 1-3 ins. long, ovate oblong or lobed, long pointed, smooth, stalk 1 in. long ; flowers purple, ½-¾ in. diam., in loose hanging clusters, calyx teeth 5 blunt, $\frac{1}{20}$ in. long, corolla lobes 5 curved back, stamens 5, anther tips meeting above ; berry ¼ in. diam., round, red, seeds many, $\frac{1}{16}$ in. dia., smooth.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED.

Solanum verbascifolium, *Kala mewa, tiari, ola.* SOLANACEÆ. F. B. I. iv. 230. The Plains to 5,000 ft. Valleys below Simla (Collett).	large, woolly with star-shaped hairs at end of branches and flower stalks, bark light grey ; leaves 7-9 by 3-5, oblong, narrowed at both ends, margins smooth, tip long-pointed ; flowers white, ½-¾ in. diam., crowded in stalked branched clusters, corolla woolly without, stamens 5, anther tips meeting above ; berry ⅓ in. diam., round, smooth yellow, seeds many, ⅛ in. diam.
Withania somnifera, *Agsend, ak, aksan.* SOLANACEÆ. F. B. I. iv. 239. The Plains. Lahore.	small, thinly woolly, branches round ; leaves 2-4 ins. long, ovate short pointed, stalk ¼-½ in. ; flowers greenish yellow, axillary, sessile or shortly stalked in clusters, or solitary, calyx in flower ⅕ in., in fruit ¾ in., bell-shaped, 5-6 toothed, in fruit enlarged and nearly round, papery, corolla bell-shaped ¼-½ in., lobes 3-6, short ; berry round, ¼-⅓ in. diam., seeds many, $\frac{1}{12}$ in. diam. The root is narcotic and diuretic.
Withania coagulans, **The Cheesemaker,** *Panirband, spinbajja.* SOLANACEÆ. F. B. I. iv. 240. The Plains to 3,000 ft. Sutlej Valley (Collett). Shahpur (Douie).	small, greyish from minute star-shaped hairs ; leaves 1-2 ins. long, oblong, blunt, thick, narrowed at the base, very shortly stalked ; flowers pale yellow, mealy from the minute star-shaped hairs outside, ½ in. diam. in short stalked hanging axillary clusters, calyx ⅕ in. in flower, ⅔ in. in fruit, velvety, corolla bell-shaped, lobes turned back ; berry and seeds as in the last species *W. somnifera*. The fruit is emetic when fresh, anodyne and carminative when dry.
Lycium europæum, *Kangu, mral, chirchitta.* SOLANACEÆ. F. B. I. iv. 240. The Plains to 5,000 ft.	small, spinous ; leaves ½-1 in. long, often clustered at the joints, linear-oblong ; flowers purplish white, ½ in. diam., solitary or in clusters at the joints, calyx often 2 lipped, 5 teeth, not larger in fruit, ⅛ in. corolla, funnel-shaped, lobes 5-4, half the length of the tube, stamens 5-4 on the corolla tube, smooth at the base berry ⅙ in. diam., nearly round, many seeded. The berries are edible and considered to be aphrodisiac.
Lycium barbarum, *Barghauna.* SOLANACEÆ. F. B. I. iv. 241. The Plains to 3,000 ft. Lahore.	same as the last species except that the corolla lobes are more than half as long as the tube.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS UNITED

Lycium ruthenicum,
Kichar, kitserma.
SOLANACEÆ.
F. B. I. iv. 241.
Kashmir, 6-9,000 ft.

same as the last species except that the leaves are linear, calyx is 3-4 lobed and the stamens are hairy at the base.

PETALS NONE.

Dodonæa viscosa,
Sanatta, mendu, ghuraske.
SAPINDACEÆ.
F. B. I. i. 697.
The Plains to 4,000 ft.
Salt Range.
Hazara. (Barrett).

medium size, evergreen, young leaves and shoots sticky with yellow resinous dots, smooth red branchlets ; leaves nearly sessile, $1\frac{1}{2}$-3 by $\frac{1}{5}$-1 ins., lanceolate with a broad tip to linear wedge shaped, leathery ; flowers small, yellow in short terminal racemes, sepals 5, ovate, petals none, stamens usually 8 ; capsule 3-(or 2-4) celled, valves winged on the back, wings membranous round, broad ; seeds 1-3. This plant is often grown as a hedge plant.

Bosia Amherstiana,
AMARANTACEÆ.
F. B. I. iv. 716.
Himalaya, 4-7,000 ft.
Simla (Collett)
Diktali in Giri Valley.

medium size, stout, smooth, branches long, straggling ; leaves 3-7 by 1-4 ins., ovate, shortly stalked, short pointed, base pointed or rounded, narrowed into the stalk ; flowers green with white margins, $\frac{1}{6}$ in. diam., nearly sessile, crowded in axillary, simple or branched spikes, never longer than the leaves, or in branched terminal racemes, sexes usually separate, sepals 5, rounded, concave, stamens 5, bracteoles 2-4 ; berries $\frac{1}{6}$ in. diam., round, red.

Ærua javanica,
Böikalan.
AMARANTACEÆ.
F. B. I. iv. 727.
The Plains.

small, grey woolly, stem rounded, 2-3 ft., branched, $\frac{1}{4}$ in. thick ; leaves 1-4 ins., flat or with margins curved down, sessile or narrowed into the stalk, linear or oblong ; flowers $\frac{1}{10}$ in. long, covered with white wool in long spikes ; sexes usually separate, sepals 4-5, woolly, stamens 4-5, joined below, alternating with linear staminodes in a cup, styles short or long ; fruit dry, ovoid, surrounded by the sepals with one seed.

Eurotia ceratoides,
CHENOPODIACEÆ.
F. B. I. v. 8.
Himalaya, 8-14,000 ft.

small, grey with star-shaped hairs ; leaves $\frac{1}{2}$-$1\frac{1}{2}$ ins. long, linear-oblong, blunt, floral leaves narrower, margin often curved down ; flowers minute, no petals, fruiting bracts with long red brown silky hairs $\frac{1}{3}$ in. long, stamens 4, sepals 4, in female flowers bracts 4, joined together, stigmas 2, seed one.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Suæda fruticosa,
Lána, ankasa, zamai.
CHENOPODIACEÆ.
F. B. I. v. 1[illegible].
The Plains

small, stem and branches slender, the latter many; leaves $\frac{1}{6}$-$\frac{1}{2}$ in. long, linear and $\frac{1}{2}$ cylindrical blunt, floral leaves very small, fleshy; flowers minute on leafy spikes, bracteate and 2 bracteolate, 5 lobed, equal or unequal, stamens 5, short; styles 3, seed coat black shining. The leaves are used in ophthalmia and used in making coarse soda (sajji).

Salsola foetida,
Motilane, goralane, shora.
CHENOPODIACEÆ.
F. B. I. v. 18.
The Plains.

small, pale grey, much branched: leaves minute fleshy, nearly round, floral leaves longer overlapping; flowers small, 5 oblate, axillary or on short spikes, bracteoles leaf-like, sepals 4-5, concave, $\frac{1}{10}$ in. across, silvery white, winged, stamens 5 or less on separate flowers from those the 2-3 linear stigmas, which are often turned down, the little flowers look like silver stars among the leaves, galls $\frac{1}{1}$-$\frac{3}{4}$ in. diam., often found on the branchlets. Manna is sometimes obtained from the surface of the leaves and the plant is used in making coarse soda.

Salsola verrucosa,
CHENOPODIACEÆ.
F. B. I. v. 18.
North-West Frontier Province.

large, stout, like the last species, but the flowers are larger $\frac{1}{4}$-$\frac{1}{3}$ in. diam., dark-brown.

Daphne oleoides,
Kutilal, shing, kagsari.
THYMELÆACEÆ.
F. B. I. v. 193.
Himalaya, 3-9,000 ft.
Simla (Collett).
Hazara (Barrett).

small, branches many, velvety; leaves, sessile 1-2$\frac{1}{2}$ ins. long, ovate or lanceolate with broad tip, sharp pointed or blunt, sometimes a little hairy; flowers pinkish white, $\frac{1}{12}$ in. long in terminal clusters, calyx tubular, 4 spreading lobes, ovate, no bracts; stamens 8 in two series nearly sessile; fruit is a berry dry or fleshy, $\frac{1}{4}$-$\frac{1}{2}$ in. long, orange or scarlet, seed one. The leaves are poisonous to camels. The bark is considered to be an alterative and used in diseases of the bones.

Daphne cannabina,
Satpura, niggi, jeku.
THYMELÆACEÆ.
F. B. I. v. 193.
Himalaya, 5-7,000 ft.
Simla (Collett).

medium size, branches smooth, leafy at the tips; leaves 2-4 ins. long, nearly sessile, lanceolate, rather leathery; flowers sessile $\frac{1}{2}$ in. long, white in bracteate terminal clusters, calyx tubular, woolly outside, scented, lobes 4, ovate, stamens 8 in two series, nearly sessile; berry $\frac{1}{2}$ in. long, ovoid, orange to red, fleshy. The plant supplies a useful fibre which is used in paper making, especially in Nepal paper.

Wikstræmia cancscens,
Bhat niggi, thilak.
THYMELÆACEÆ.
F. B. I. v. 195.
Himalaya, 5-9,000 ft.
Narkanda, Paternala (Collett).

small, branches slender, silky, velvety; leaves 1-3 ins., shortly stalked, oblong-lanceolate, thin, often with a white bud in the axil; flowers yellow or white in axillary or terminal few clusters or spikes without bracts, calyx tube $\frac{1}{4}$-$\frac{1}{3}$ in. long, lobes 4, spreading, short, blunt, scales 1-4 linear within the tube, stamens 8, short, within and upon the tube, in two rows; fruit $\frac{1}{4}$ in. long, narrowly ovoid, black, within the calyx tube at first. This plant is also used in paper making and the fibre forms good cordage.

Elæagnus umbellata,
Ghaw, kankol mirch, bammewa.
ELÆAGNACEÆ.
F. B. I. v. 201.
Himalaya, 3-10,000 ft.
Simla, Mashobra (Collett).
Hazara (Barrett).

medium size, spinous, branches dark; leaves 1-3, by $\frac{1}{2}$-1 in., oblong lanceolate, blunt, smooth or with star-shaped hairs above, silvery scaly beneath, stalk $\frac{1}{4}$ in.; flowers white, scented, silvery without, in small axillary clusters, appearing with the leaves, calyx $\frac{1}{2}$ in. long, silvery, tube slender, funnel-shaped, teeth 4, broadly triangular, stamens 4; fruit $\frac{1}{3}$ in. long, oblong succulent, edible, stone bony, ribbed, woolly within. The seeds and flowers are used as a stimulant in coughs, and as a substitute for black pepper.

Hippophaë rhamnoides,
Sea Buckthorn,
Kala bisa, tserkar, sirma.
ELÆAGNACEÆ.
F. B. I. v. 203.
Himalaya, in the beds of streams, 7-12,000 ft.
Lahoul, Pangi.

large, spinous, bark dark grey, rough with vertical furrows, branches stiff with silvery twigs and leaves; leaves $\frac{1}{2}$-2 ins. by $\frac{1}{10}$-$\frac{1}{4}$ in., linear oblong to ovate with broad tip, rather leathery, smooth above, felted beneath with grey or rusty scales; flowers male in axillary clusters, female solitary, calyx in male in two segments, in female two toothed, in male stamens 4; fruit $\frac{1}{4}$ in. long, ovoid, orange or scarlet, succulent, acid but edible, seed oblong, shining. The fruit is very acid and used as a syrup for coughs.

Hippophaë salicifolia,
Surch, dhur chuk, chuma.
ELÆAGNACEÆ.
F. B. I. v. 203.
Himalaya, 5-10,000 ft.
Sutlej Valley (Collett).

large, spinous, willow-like, leaves 2-4 ins., linear lanceolate dark green above, covered with stellate hairs and few scales, beneath otherwise like the last species.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Osyris arborea, *Dalmi, dalima.* SANTALACEÆ. F. B. I. v. 232. Himalaya, 1-7,000 ft. Simla (Collett).	large, young shoots sharply 3-angled ; leaves 1-2 ins. long, nearly sessile, oblong-ovate, tip short-pointed ; flowers very minute, yellow green, nearly sessile, calyx 3-4 lobed, male flowers in axillary clusters, female one to three together on long stalks ; fruit $\frac{1}{4}$ in., round, yellow to red, seed one, round. The leaves are made into Bischar tea, which is drunk in Ladak, but is very nauseating.
Euphorbia Tirucalli,	see Shrubs, Opposite, Exstipulate, Simple.
Sarcococca pruniformis, EUPHORBIACEÆ. F. B. I. v. 266. Himalaya, 5-9,000 ft. Simla (Collett). Hazara (Barrett). Murree.	small, smooth, evergreen, branches green, rounded ; leaves 3-4 by $\frac{1}{2}$-1 in., nearly sessile, lanceolate, long pointed, dark-green, margin smooth; flowers $\frac{1}{3}$ in. long, pale yellow in short axillary racemes ; male flowers, sepals 4, oblong blunt, stamens 4, female flowers, sepals 4-6 of small overlapping scales, styles 2, long, recurved ; fruit $\frac{1}{3}$ in. long, ovoid, purple, stones 2-3.
Flueggia microcarpa, EUPHORBIACEÆ. F. B. I. v. 328. The Plains to 5,000 ft. Valleys below Simla (Collett).	large, smooth, branchlets angled, flattened ; leaves in two rows, 1-3 ins. long, shortly stalked ovate or round, thin ; flowers minute, yellow green, in dense axillary clusters on separate stalks, male and female flowers on different plants, male sepals 5, round, oblong, concave, spreading, stamens 5, opposite sepals, around 3 styles, long linear, erect, female shortly stalked in clusters of 3-6, sepals erect, 5, styles 3-4 reflexed and each divided into 2 or 3, pointed narrow lobes ; fruit $\frac{1}{6}$-$\frac{1}{3}$ in. diam , dry, a few $\frac{1}{3}$ in., white fleshy, minutely dotted, seeds 3-6, minutely dotted.
Flueggia Leucopyrus, EUPHORBIACEÆ. F. B. I. v. 328. The Plains.	same as last species, but branches twisted, spinous: leaves smaller 1in. long at most, longer stalked.
Salix hastata,	see Shrubs, Alternate, Stipulate, Simple.

SHRUBS WITH ALTERNATE EXSTIPULATE SIMPLE LEAVES.

PETALS NONE.

Juniperus communis,
Juniper,
Patthar, lewar, pama.
CONIFERÆ.
F. B. I. v. 646.
Himalaya, 5-14,000 ft.
Hattu (Collett).
The Chor. (Bamber).

small, dense, erect, prostrate at high elevations' greyish green; leaves linear, $\frac{1}{4}$-$\frac{3}{4}$ in., straight in threes, pointed, concave above, convex below, male cones $\frac{1}{8}$ in. long, many, ovoid, female cones minute bud-like consisting of many overlapping bracts, fruits compound like a berry, purple black with a bloom, the bracts just visible, seeds 3. The berries are used in the distillation of gin, also as a diuretic, the wood and leaves are burnt in the Punjab for incense.

Juniperus pseudo-sabina,
Bhil, bhentri.
CONIFERÆ.
F. B. I. v. 646.
Himalaya, 9-15,000 ft.
Hazara (Barrett).

medium size, dark coloured bark; leaves of two kinds, those on lower branches $\frac{1}{3}$ in. long, linear, sharp pointed, spreading, those on the terminal branchlets $\frac{1}{10}$ in. long., broadly ovate, closely overlapping, tips free, back keeled; flowers like the last species; fruit erect, ovoid, $\frac{1}{4}$-$\frac{2}{3}$ in., one seeded.

Juniperus recurva,
Weeping Blue Juniper,
Bettar, bhentra, guggal.
CONIFERÆ.
F. B. I. v. 647.
Himalaya, 7,500-15,000 ft.
The Chor (Collett).

medium size to small prostrate shrub, bluish green, branches twiggy with hanging branchlets; leaves in whorls of 3, $\frac{1}{5}$ in. long, curved, linear, sharp pointed, flat and bluish green above, curved and pale green below, cones terminal, male yellow; fruit ovoid, $\frac{1}{3}$-$\frac{1}{2}$ in., dark purple, seed solitary. The smoke of the burning green wood acts as a violent emetic, the leaves and wood are burnt as incense.

SHRUBS WITH ALTERNATE EXSTIPULATE LOBED LEAVES.

PETALS UNUNITED.

Ribes Grossularia,
Rough Gooseberry,
Amlanch, kansi, teila.
SAXIFRAGACEÆ.
F. B. I. ii. 410.
Himalaya, 9-12,000 ft.
Pangi (Watt).

small, usually 3 prickles beneath each leaf axil, stems smooth or with many prickly hairs; leaves nearly round with 3-5 lobes, often toothed, hairy beneath; flowers stalked in clusters of 1-3 flowers, stalks with bracts at the base and 2 bracteoles at the middle, calyx tube long, lobes 4-5 produced above the fruit, petals 4-5, small, stamens 4-5; berry $\frac{1}{2}$ in. long oblong, inedible, seeds several.

SHRUBS WITH ALTERNATE EXSTIPULATE LOBED LEAVES.

PETALS UNUNITED.

Ribes orientale,
Kaghak, nangke.
SAXIFRAGACEÆ.
F. B. I. ii. 410.
Kashmir, 8-12,000 ft.
Baltistan.
Kaghan.

medium size, sticky with glands and minutely hairy ; leaves 1-1$\frac{1}{2}$ ins. diam., round kidney shaped, minutely toothed, 3-5 lobed ; flowers small, greenish in erect crowded racemes, bracts $\frac{1}{5}$ in. long, linear, calyx tube hardly produced above the fruit, lobes 4-5, petals 4-5, stamens 4-5 ; berry $\frac{1}{3}$ in. long, yellowish red, velvety with minute glands, seeds several.

Ribes glaciale,
Kukuliya, mangle, durbui.
SAXIFRAGACEÆ.
F. B. I. ii. 410.
Himalaya, 7-12,000 ft.
Hattu (Collett).
The Chor (Bamber).

small, smooth, often epiphytic ; leaves 1-3 ins. diam., cordate, 3-5 lobed, acute, often long pointed, midlobe largest, pale beneath ; flowers greenish brown, $\frac{1}{4}$ in. diam., in glandular racemes 1-2 in., long erect in flower, hanging down in fruit, male and female flowers usually on different plants, bracts narrowly lanceolate, longer than the flower stalks, calyx lobes oblong, 4-5, petals 4-5, stamens 4-5 ; berries $\frac{1}{4}$ in. long, smooth, red, sour, scarcely edible.

Ribes nigrum,
Black currant,
Muradh, beli, shaktekas.
SAXIFRAGACEÆ.
F. B. I. ii. 411.
Himalaya, 7-12,000 ft.
Changlagalli (Douie).
The Chor. (Bamber).

small, velvety ; leaves scented, 2-4 ins. diam., long stalked, lobes 3 or 5, smooth above, dotted with minute yellow glands below : flowers green tinged with purple, $\frac{1}{3}$ in. diam., stalks of lower flowers longest, in smooth drooping racemes 2-3 in. long, calyx tube produced above the fruit, gland dotted, lobes 4-5, petals 4-5, stemens 4-5 ; berry $\frac{1}{3}$ in. diam., black, seeds several. The fruit is as large and palatable as the English Black Currant.

Ribes rubrum,
Red currant,
Dak, phulanch, nabar.
SAXIFRAGACEÆ.
F. B. I. ii. 411.
Himalaya, 8-12,000 ft
Mahasu, Narkanda
(Collett).
Changlagalli (Douie).

small, nearly smooth ; leaves 2-3 ins. diam., long-stalked, hairy at the base, ovate lobes, 3-5 acute, toothed, smooth or with few hairs above ; flowers greenish yellow, $\frac{1}{3}$ in. diam., stalks short, bracts shorter than the stalks in smooth pendulous racemes 3-6 ins. long ; calyx tube above the fruit, lobes short, blunt, 4-5, petals 4-5 ; berry $\frac{1}{4}$ in. diam., red, rarely black, smooth, too acid to be palatable.

SHRUBS WITH ALTERNATE EXSTIPULATE LOBED LEAVES.

PETALS UNITED.

Tricholepis tibetica, COMPOSITÆ. F. B. I. iii. 382. Northern Kashmir, 8-12,000 ft.	small, branches clustered above, slender, twiggy ending in a stiff flower stalk with a small erect head ; leaves 1-3 ins. long, sessile, leathery, very narrow blunt, lobed, upper $\frac{1}{2}$-1 by $\frac{1}{10}$-$\frac{1}{8}$ in., ovate, linear, margin not lobed ; flowers scarlet, in heads $\frac{1}{2}$-$\frac{3}{4}$ in. diam., bracts round heads, outer ovate, needle pointed, inner lanceolate, needle pointed, $\frac{1}{2}$ in. long, corollas $\frac{1}{2}$ in. ; long ; fruit (achenes) $\frac{1}{6}$ in. long, rather ribbed, a brush of hairs on top of each achene $\frac{1}{3}$ in. long.
Solanum dulcamara,	see Shrubs, Alternate, Exstipulate, Simple.
Solanum indicum, *Kandyari.* SOLANACEÆ. F. B. I. iv. 234. The Plains to 5,000 ft. Valleys below Simla (Collett).	small, branches many, very prickly, prickles stout, flattened, often recurved ; leaves 3-6 by 1-4 ins., ovate, lobed, star-shaped hairs above, woolly beneath, nerves prickly, stalk 1 in. long ; flowers $\frac{3}{4}$-1 in. diam. in lateral woolly recemes, calyx 5 lobed $\frac{1}{6}$ in. triangular, very woolly, corolla lobes 5, broad triangular, woolly without, stamens 5, forming a cone ; berry yellow, $\frac{1}{3}$ in. diam., round, smooth, protruding beyond the calyx lobes, seeds $\frac{1}{8}$ in. diam., discoid. The root is said to be aphrodisiac.
Solanum Melongena, **The Egg-plant,** *Brinjal bengan.* SOLANACEÆ. F. B. I. iv 235. The Plains to 4,000 ft.	small, prickly or unarmed ; leaves 3-6 by 2-4 ins., stalk 1 in., ovate lobed, star-shaped hairs beneath ; flowers blue, 1-1$\frac{1}{4}$ in. diam., in short small clusters, calyx lobes $\frac{1}{4}$-$\frac{1}{2}$ in., oblong, linear, corolla shortly lobed, stamens 5, forming a cone ; berry 1-9 ins., purple green, seeds very many, discoid. Generally cultivated.
Solanum coagulaus, *Bari mauhari, tingi.* SOLANACEÆ. F. B. I. v. 236. The Plains.	very like the last species, but the berry is only 1 in. diam., and yellow. The fruit is sometimes eaten fresh or pickled.

PETALS NONE.

Ricinus communis, **The Castor Oil Plant,** *Arend, bedanjir, harnauli* EUPHORBIACEÆ. F. B. I. iv. 457. The Plains.	large, stem hollow, young shoots bluish green ; leaves 6-24 ins. diam., green to red, round, 5-7 lobed, lobes toothed, membranous, oblong to linear, sharp or long-pointed, stalk 4-12 ins. long ; flowers $\frac{1}{2}$ in. diam. in terminal erect branching recemes, male and female on different plants, male flower, calyx membranous.

SHRUBS WITH ALTERNATE EXSTIPULATE LOBED LEAVES.

PETALS NONE.

3-5 segments, petals none, stamens very many, female flower, calyx like a folding bract or spathe, soon falling off, ovary 3-celled, styles short or long, undivided or in 2 or 3 parts ; capsule ½-1 in. long, oblong, smooth or with tubercles, seeds 3, oblong, spotted. The oil is used as a purgative also as a lubricant and an illuminant. The plant is cultivated and is probably indigenous, and not a mere escape.

Nannorhops Ritchiana,
Dwarf Palm,
Mazri, kilu.
PALMACEÆ.
F. B. I. vi. 429.
N.-W. Frontier Province.
Salt Range to 3,000 ft.

large, stem 8-10 ft. long, 4 ins. diam. ; leaves 2-3 ft. in diam., round, split into segments, stalk 6-12 ins., margins toothed, sheathing ; flowers small on a spike (spadix) with branches and branchlets forming a pyramid 2-3 ft. long, flowers in pairs, one sessile, the other stalked, contained in a small spathe (sheathing bract), the whole pyramid contained in a large spathe, sepals and petals 3 each, stamens 3 or 6, drupe round, size of a pea to a bullet, one-seeded. The leaves are made into matting, baskets and cordage.

SHRUBS WITH ALTERNATE STIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Glycosmis pentaphylla,
Ban nimbu, potali, girgitti.
RUTACEÆ.
F. B. I. i. 499.
The Plains to 5,000 ft.

small, evergreen, smooth ; leaves of 3-5 leaflets, rarely one, stalk stout, leaflets 4-9 ins. long, ovate lanceolate, blunt or pointed, dark-green, smooth ; flowers white, scented, small in erect, terminal or axillary, branched racemes, calyx 4-5 lobed, lobes broad, petals 4-5, stamens 8-10 ; fruit round with a depression, ⅓ in. diam., white or pink, pulp sweetish, edible. The twigs are used as toothsticks.

Murraya exotica,
Marchula, juti, bibsar.
RUTACEÆ.
F. B. I. i. 502.
The Plains to 5,000 ft.
Sutlej Valley (Collett).
Rawulpindi.

large, bark ash-coloured, smooth, young parts velvety ; leaves 4-5 ins. long, leaflets 3-7, 1-3 ins. long, shortly stalked, dark-green, smooth, ovate, oblique at the base, notched at the tip or pointed, gland dotted ; flowers white, scented, 1 in. long, in short axillary or terminal clusters, rarely solitary, calyx 5-lobed, lobes minute, short-pointed, petals 5, lanceolate, stamens 10 ; berry ½-¾ in. long, ovoid, pointed at each end, wrinkled, red, 1-2-seeded.

Murraya Kœnigii, see Trees, Alternate, Exstipulate, Compound.

SHRUBS WITH ALTERNATE EXSTIPULATE COMPOUND LEAVES.

PETALS UNUNITED.

Limonia acidissima, *Beli.* RUTACEÆ. F. B. I. i. 507. The Plains to 4,000 ft. Valleys below Simla (Collett).	large, armed with long spines, smooth, white corky bark ; leaves 3-6 ins. long, stalk with broad wings, leaflets 5-9, $\frac{1}{2}$-$1\frac{1}{2}$ ins. long, sessile, ovate lanceolate, long-pointed, gland dotted, toothed, tip notched ; flowers white, scented, $\frac{1}{3}$ in. diam., in short axillary, often leafy racemes, calyx 4-lobed, persistent, petals 4, gland dotted, larger than the calyx, stamens 8 ; berry $\frac{1}{3}$ in. diam., round, yellow turning to purple, acid, smooth, seeds 2-4.
Picrasma quassioides, *Puthorin, tithu, hala.* SIMARUBACEÆ. F. B. I. i. 520. Himalaya, 3-5,000 ft.	large, branches spotted, stout, bark very bitter, young parts velvety ; leaves 10-18 ins. long, leaflets 9-15, 2-4 ins. long, sessile, ovate lanceolate, long-pointed, toothed, the lowest pair much the smallest ; flowers $\frac{1}{5}$ in. across, green in axillary branching recemes, calyx 4-5 lobed, very small, petals 4-5, much larger than the calyx, leathery and persistent in fruit, stamens 4-5, hairy at the base, fruit of 3-5 drupes, size of a pea, red or black, each one-seeded, sometimes eaten. The bark, wood, and root are very bitter, and might be used as a tonic instead of Quassia.
Rhus parviflora, **Sumac,** *Tungla, tumra.* ANACARDIACEÆ. F. B. I. ii. 9. Himalaya, 2-5,000 ft.	medium size, bark grey smooth, young rusty woolly ; leaves of 3 leaflets, stalk 1-2 ins., rusty woolly, leaflets 1-3 by $\frac{1}{2}$-2 ins., the terminal one much the largest and often narrowed into a margined stalk, ovate with a broad tip, toothed, slightly hairy above, rusty woolly beneath ; flowers yellow green, $\frac{1}{10}$ in. diam. in hairy terminal, often leafy, branching racemes 12 ins. long, calyx lobes 4-6, ovate, hairy without, petals 4-6, twice as long as the calyx lobes, oblong, stamens 4-10 ; drupe $\frac{1}{6}$ in. ovoid, shining brown seed one. The fruit (tantarik) is sold in the bazaar as substitute for tamarind.
Rhus Mysorensis, *Dasarni, dasan.* ANACARDIACEÆ. F. B. I. ii. 9. The Plains. N.-W. Frontier Province. Suliman Range, 3 5,000 ft.	small, branches springy, woody, often spinous, branchlets scurfy ; leaves of 3 leaflets, stalk $\frac{1}{2}$-$\frac{2}{3}$ in., scurfy, leaflets $\frac{1}{2}$-$1\frac{1}{2}$ ins. long, terminal much the largest, all sessile, scurfy beneath, tinged with red ; flowers $\frac{1}{12}$ in. diam. in slender scurfy axillary or terminal branching racemes, in other points like the last species. The bark is sometimes used for tanning.

Shrubs with Alternate Exstipulate Compound Leaves.

Petals United.

Jasminum humile, *Chamba, jai, shing.* OLEACEÆ. F. B. I. iii. 602. Himalaya, 2-5,000 ft. Salt Range. Simla (Collett). Murree (Douie).	small, smooth, branches angular green ; leaves 2-4 ins. long, leaflets 2-10, 2-3 by $\frac{3}{4}$-$1\frac{1}{4}$ ins. ovate, acute or blunt at both ends ; flowers yellow in terminal clusters, many, $\frac{1}{2}$-$\frac{3}{4}$ in. long, calyx teeth 5, $\frac{1}{16}$ in. triangular, corolla united, lobes $\frac{1}{3}$ by $\frac{1}{5}$ in. flat circular, 5, stamens 2 in the corolla tube ; berries 2-lobed or 1-lobed, oblong with rounded ends, seeds one in each lobe. An aromatic essential oil is obtained from the flowers by native perfumers.

ERECT HERBS.

Herbs erect with Opposite Stipulate Simple Leaves.

Leaf Margins Entire.

Petals Ununited.

Spergula arvensis, **Corn Spurrey,** CARYOPHYLLACEÆ. F. B. I. i. 243. The Plains to 7,000 ft. Simla (in corn fields) (Collett).	medium size, annual, branched from the root, knotty, often sticky ; leaves linear $\frac{1}{2}$-2 ins. in opposite clusters, half round, grooved below, rather fleshy, stipules thin dry, small ; flowers $\frac{1}{6}$-$\frac{1}{4}$ in. diam., in forked terminal clusters on long stalks, turned back after flowering, sepals 5, blunt, green, unjoined, petals 5, white, blunt slightly longer than the sepals, stamens 10, styles 5; capsule nearly round, shining, longer than the calyx, opening by 5 valves ; seeds many, keeled or narrowly winged, granular.
Spergula pentandra, CARYOPHYLLACEÆ. F. B. I. i. 243. The Plains to 7,000 ft. (in corn fields).	much the same as the last species, but leaves bluish green, not grooved below, petals sharp pointed, styles 3, seeds smooth flattened, broadly winged.
Spergula rubra, **Sand Spurrey,** CARYOPHYLLACEÆ. F. B. I. i. 244. The Plains. Shahpur (Douie).	small, stems 6-8 ins. long, annual ; leaves $\frac{1}{2}$-1 in. long, linear, flat, fleshy, stipules split, broad, silvery flowers $\frac{1}{4}$-$\frac{1}{3}$ in. diam., pink or white, sepals 5, lanceolate, blunt, margins thin, dry, petals 5, ovate with broad tips, shorter than the sepals, stamens 5 or 10, styles 3 ; capsule ovoid, longer than the calyx, seeds many, pale brown, rough, not winged.

Herbs erect with Opposite Stipulate Simple Leaves.

Leaf Margins Entire.

Petals Ununited.

Drymaria cordata, CARYOPHYLLACEÆ. F. B. I. i. 244. The Plains to 7,000 ft.	large, annual, smooth, found in shady moist places, branches forking into two, slender, 1-2 ft.; leaves flat, stalked, ovate or round tipped with an abrupt point, stipules of a few bristles, soon falling off; flowers $\frac{1}{6}$-$\frac{1}{4}$ in. diam., in axillary or terminal clusters, stalks slender, bracts with thin edges, sepals 5, green, petals 5; two-lobed, lobes narrow, not longer than the sepals, stamens 3-5, style short; capsule 3 angled 3-valved; seeds one to many, round, flattened, rough with hard projections.
Polycarpon Loeflingiæ, CARYOPHYLLACEÆ. F. B. I. i. 245. The Plains.	small, annual, smooth or velvety, common in gardens and waste places; leaves flat, $\frac{1}{4}$-$\frac{3}{4}$ in. long, sharp-pointed or blunt, wedge shaped, linear-oblong, stipules small, thin, soon falling off; flowers $\frac{1}{8}$ in. diam. in clusters at the end of branches or in their forks, sepals 5, keeled, petals 5, thin, notched or not, stamens 3-5, style divided into three; capsule one-celled; seeds many, ovoid, grooved.
Polycarpæa corymbosa, CARYOPHYLLACEÆ. F. B. I. i. 245 The Plains to 7,000 ft. Giri Vally (Collett).	small, annual or perennial, much branched, grey woolly or velvety; leaves $\frac{1}{3}$-1 in. long, flat, narrow linear, long or short pointed or blunt, stipules lanceolate or awl-shaped, thin; flowers $\frac{1}{6}$ in. diam., white in terminal silvery much branched clusters, sepals 5, thin, lanceolate much longer than the petals and capsule, often coloured, petals 5, margin smooth or 2-toothed, stamens 5, style one, tip 3-toothed; capsule 3-valved, seeds many, ovoid or flattened.
Portulaca quadrifida,	see Prostrate Herbs, Opposite, Stipulate, Simple Leaves.
Mollugo hirta,	see Prostrate Herbs, Opposite, Stipulate, Simple Leaves.

HERBS ERECT WITH OPPOSITE STIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS UNITED.

Argostemma verticillatum,
RUBIACEÆ.
F. B. I. iii. 43.
Himalaya 2-6,000 ft.
Simla (Collett).

small, annual, slender, nearly smooth, growing on wet rocks ; leaves in fours, sessile, unequal, lanceolate or ovate-lanceolate, 1-4 ins. long, stipules minute ; flowers $\frac{1}{3}$ in. diam. white , shining in terminal stalked clusters, calyx 5-toothed, teeth short-pointed, corolla wheel-shaped, 5-lobed, stamens 5, style slender, stigma round ; capsule thin, 2-celled ; seeds many.

Hedyotis hispida,
RUBIACEÆ.
F. B. I. iii. 60.
Himalaya to 5,000 ft.
Valleys below Simla (Collett).

small, annual, stems angular, rough, much branched, sometimes prostrate ; leaves sessile $1\frac{1}{2}$-$2\frac{1}{2}$ ins. long, very variable in width, linear-lanceolate, short or long-pointed, margins turned in, stipules very short with many stiff bristles ; flowers small, white, 2-6 in sessile axillary rounded clusters, calyx lobes 4, short-pointed, persistent, roughly bristly, corolla bell-or-funnel shaped, lobes 4, ovate or linear, stamens 4 in the throat of the corolla, style thread-like, stigma 2-lobed ; capsule ovoid or round, 2-celled, seeds many, minute.

Hedyotis stipulata,

see Prostrate, Herbs, Opposite, Stipulate, Simple.

Oldenlandia corymbosa,
RUBIACEÆ.
F. B. I. iii. 64.
The Plains to 6,000 ft.
Annandale, Simla (Collett).
Murree Hills (Douie).

small, annual, slender, minutely bristly ; leaves $\frac{1}{2}$-2 ins. long, linear-lanceolate, short pointed, margins often curved back, stipules small, thin, with long or short teeth or bristles ; flowers white, small, solitary on long slender axillary stalks, or 2-4 in a small cluster, calyx-tube ovoid, teeth 4, narrow pointed, corolla flat and circular topped, lobes 4, tube short, stamens 4, within the corolla tube, style short, stigma 2-lobed ; capsule round, not ribbed, 2-celled, opening at the top, seeds many, minute.

Oldenlandia aspera,
RUBIACEÆ.
F. B. I. iii. 68.
The Plains.

small, annual, thick, stem rough, branching in threes ; leaves 2-3 ins. long, in clusters, narrow linear, short pointed, margins turned under, leathery, stipules thin with 1-3 terminal bristles ; flowers blue, $\frac{1}{3}$ in. long, nearly sessile, solitary or in pairs on three branching clusters, calyx teeth 4, much shorter than the corolla tube, awl-shaped, corolla funnel-shaped, tube $\frac{1}{10}$ in. long, slender, lobes 4, stamens 4, within

Herbs erect with Opposite Stipulate Simple Leaves.

Leaf Margins Entire.

Petals United.

the corolla tube, style short, stigma 2-lobed ; capsule round, $\frac{1}{8}$ in. diam. rough, seeds many, angled.

Oldenlandia coccinea,
RUBIACEÆ.
F. B. I. iii. 69.
Himalaya, 3-8,000 ft.
Simla on grassy slopes (Collett).

small, annual, slender, stem minutely bristly, often unbranched ; leaves $\frac{1}{2}$-$1\frac{1}{2}$ in. long, distant in pairs, narrowly lanceolate, short-pointed, rough, margins curved back, stipules bristly ; flowers scarlet, $\frac{1}{4}$ in. diam. axillary or terminal, solitary or 2-4 in small clusters, stalks short, lengthened in fruit, calyx teeth 4, very long, equal to the corolla tube, corolla tube $\frac{1}{8}$ in. long, lobes oblong, stamens 4 in the tube, style short, stigma 2-lobed ; capsule oblong or round, $\frac{1}{8}$-$\frac{1}{4}$ in. long, seeds many, angled.

Anotis calycina,
RUBIACEÆ.
F. B. I. ii. 73.
Himalaya, 3-7,000 ft.
Simla, Masnobra, (Collett).

small, annual, slender, smooth, stems tufted, 4-angled ; leaves $\frac{1}{4}$-1 by $\frac{1}{3}$-$\frac{1}{2}$ in., ovate or ovate-lanceolate, shortly stalked, long-pointed, stipules thin with short bristles on margins ; flowers small, white or lilac, axillary or terminal, solitary on slender stalks or 2-4 in a small cluster, calyx ovoid, teeth 4, minute, widely separated in fruit, corolla short, tubular, 4-lobed, stamens 4, nearly sessile at the mouth of the corolla tube, style slender, 2-branched projecting ; capsules in pairs, opening at the top by 2 valves, seeds many, minute.

Spermacoce stricta,
RUBIACEÆ.
F. B. I. ii. 200.
The Plains to 6,000 ft.
Valleys below Simla (Collett).

small, annual, stems and branches usually square, angles rough with curved-back prickles ; leaves 1-2 by $\frac{1}{6}$-$\frac{1}{2}$ in., linear or ovate, short-pointed, leathery, smooth or rough, margins turned down, stipules joined to the leaf stems forming a short tube with long marginal bristles ; flowers white, many in dense rounded axillary heads, bracteoles thread-like, longer than the calyx. calyx ovoid, teeth usually 4, linear, persistent, corolla funnel-shaped, 4 lobed, $\frac{1}{8}$ in. long, lobes linear, acute, stamens 4 on the throat of the corolla, style thread-like, stigma round ; capsule $\frac{1}{8}$ in. long, narrow at the base, thin, crowned with the calyx teeth, dividing into two one-seeded half fruits, seeds oblong, polished.

Rubia tibetica, see Herbs, Erect, Opposite, Exstiplate, Simple.

HERBS ERECT WITH OPPOSITE STIPULATE SIMPLE LEAVES.

LEAF MARGINS ENTIRE.

PETALS NONE.

Mollugo stricta,
FICOIDEÆ.
F. B. I. ii. 663.
The Plains to 5,000 ft.
Valleys below Simla (Collett).

small, annual, smooth, much branched; leaves $\frac{1}{2}$-$1\frac{1}{2}$ ins. long, narrowly lanceolate, nearly sessile, short-pointed, stipules membranous, soon falling off; flowers $\frac{1}{10}$ in. long, orange or pink, in many terminal branching clusters, sepals 5, $\frac{1}{16}$ in. long, distinct, persistent, petals none, stamens 3-5, styles 3, short, ununited; capsule round, within the persistent calyx, seeds many, dark-brown, rough with minute points.

Pouzolzia indica.
P. pentandra,
P. hirta,

see Prostrate Herbs, Opposite, Stipulate, Simple.

Elatostemma pusillum,

see Herbs, Alternate, Stipulate, Simple, Entire.

LEAF MARGINS TOOTHED.

PETALS UNUNITED.

Bergia ammannioides,
ELATINEÆ.
F. B. I. i. 251.
The Plains in wet places.

small, annual, smooth or slightly hairy, lower branches prostrate; leaves $\frac{1}{2}$-$\frac{3}{4}$ in. long, sessile, linear-lanceolate, short-pointed, sharply toothed; flowers $\frac{1}{12}$ in., sessile or nearly so, in dense clusters, sepals 5, lanceolate, toothed, petals 5, stamens 5; capsule 5-celled, valves brittle, edges turned in, seeds ovoid, many.

Impatiens Roylei,
GERANIACEÆ.
F. B. I. i 468.
Himalaya, 6-8,000 ft.
Mahasu (Collett).
Changlagalli (Douie).

large, annual, smooth, stems succulent: leaves $2\frac{1}{2}$-6 ins. lanceolate, sharply toothed, teeth gland-tipped, long pointed, stalked, stipules of gland-tipped bristles; flowers $1\frac{1}{4}$-$1\frac{1}{2}$ ins. long minus the spur, pale pink in terminal racemes or clusters, sometimes branching racemes, sepals 3, 2 lateral minute greenish, one lower (lip) petal-like, coloured pink, cup-shaped prolonged into a hollow curved spur $\frac{1}{4}$ in. long, petals 3, one upper (standard) broad with a green tip between the two side lobes, two lower (wings) with lateral lobes, broad, notched on the margin with a little hollow at the base within, stamens 5, anthers cohering above the 5-toothed stigma with filaments clasping the ovary; capsule linear, club-shaped, beaked, nodding, 5-valved, the valves when

Herbs erect with Opposite Stipulate Simple Leaves.

Leaf Margins Toothed.

Petals Ununited.

	ripe, if shaken, curl up elastically and jerk out the numerous large broad seeds.
Impatiens Thomsoni, Geraniaceæ. F. B. I. i. 469. Inner range of the Himalaya, 9-10,000 ft.	like the last species, but a little smaller, a little bristle-like gland between the teeth on the leaf margin. stipules of cushion-like tubercles, lateral sepals ovate-lanceolate, spur long, upper petal not lobed, capsule narrowly club-shaped.
Impatiens sulcata, Geraniaceæ. F. B. I. i. 469. Himalaya, 7-12,000 ft. Simla Mahasu (Collett).	large, like *Impatiens Roylei,* but the stem grooved flowers darker pink or purple, capsule longer, less clubbed.
Impatiens amplexicaulis, Geraniaceæ. F. B. I. i 469. Himalaya, 6-12,000 ft. Simla (Collett).	like *Impatiens Thomsoni*, but stem four-angled, upper leaves alternate sessile, stem clasping, lower leaves opposite, flowers fewer and smaller, capsule hardly clubbed, 1-1$\frac{1}{4}$ ins. long.

Petals None.

Euphorbia hypericifolia, Euphorbiaceæ. F. B. I. v. 249. The Plains to 7,000 ft. Simla (Collett). Murree Valleys (Douie).	small, annual, slender, smooth, juice milky ; leaves $\frac{1}{2}$-1 by $\frac{1}{4}$-$\frac{1}{2}$ in., shortly stalked, oblong, tip rounded, margins toothed except at the base, margins may be reddish, stipules minute, bristly, divided or none ; flowers minute in terminal or axillary clusters, often with two floral leaves at the base, 4 sepals or teeth 4 with 5 green glands in the angles, stamens several, surrounding a 3-angled ovary on a stalk hanging down on one side, styles 3, very short, branched ; capsule 3-lobed, velvety, splitting into 3 valves, one smooth seed in each cell.
Euphorbia Emodi, Euphorbiaceæ. F. B. I. v. 250 Himalaya, 4-7,500 ft. Valleys below Simla (Collett.) Kulu, Chamba, Lahoul.	small, annual, hairy, purplish, juice milky, branches straggling from the short stout stem ; leaves $\frac{1}{4}$-$\frac{3}{4}$ in., in rather distant pairs, green with a purple blotch, oblong or linear-oblong, tip blunt, toothed-stipules fringed ; flower clusters, nearly sessile and solitary, $\frac{1}{16}$ in. long, like the last species but glands purple with white or rose colour ends, styles slender

HERBS ERECT WITH OPPOSITE STIPULATE SIMPLE LEAVES.

LEAF MARGINS TOOTHED.

PETALS NONE.

capsule shortly stalked, smooth, slightly angled, seeds angled with slight projections.

Euphorbia pilulifera,
EUPHORBIACEÆ.
F. B. I. v. 250.
The Plains to 4,000 ft.
Valleys below
Simla (Collett).
Bhera (Doule).

small, annual, juice milky, stem and branches 1-2 ft., very hairy; leaves $\frac{3}{4}$-$1\frac{1}{2}$ ins. long, oblong-lanceolate, tip sharp, stalked, toothed, stipules minute linear; flower clusters $\frac{1}{30}$ in. many in terminal and axillary, sessile or stalked bunches, glands small, round; capsule $\frac{1}{24}$ in. diam., hairy, seeds ovoid, in other respects like the other species of Euphorbia.

Euphorbia Clarkeana,

see Herbs, Prostrade, Opposite, Stipulate, Simple.

Urtica pilulifera,
The Roman Nettle,
URTICACEÆ.
F. B. I. i. 548.
Himalaya, 5-7,000 ft.
Simla (Collett).

small, annual, covered with stinging hairs; leaves 1-3 ins. long, ovate, teeth very long, often linear, sharp-pointed, thin, stalked; flowers green, minute, male in slender branching spikes, female in round heads, both on the same plant, male sepals 4, concave, ovate, stamens 4, curled up in bud, straightening with a jerk when the flower opens, female sepals 4, flat, unequal, stigma of a small tuft of hairs; carpel held by the sepals, flattened. An introduced European weed found near houses.

Urtica parviflora,
URTICACEÆ.
F. B. I. v. 548.
Himalaya, 5-12,000 ft.
Simla (Collett).

medium size, root perennial, stem annual, slender but little branched, with blunt angles, covered with stinging hairs; leaves 2-4 by 1-$2\frac{1}{2}$ ins., ovate or lanceolate, long-pointed, wrinkled, teeth small, irregularly jagged, stalk $\frac{1}{4}$-2 ins. long, stipules united, ovate-oblong; flowers green, minute in slender spreading axillary and terminal branching pyramidal clusters, male and females on the same plant and like those of the last species.

Urtica dicica,
The English Nettle,
URTICACEÆ.
F. B. I. v. 548.
Salt range.
Himalaya, 7-10,000 ft.
Simla, Hattu (Collett).

like the last, but often stouter, stem grooved, teeth large, regular, stipules ununited, male and female flowers on separate plants.

HERBS ERECT WITH OPPOSITE STIPULATE SIMPLE LEAVES.

LEAF MARGINS TOOTHED

PETALS NONE.

Pilea peploides,
URTICACEÆ.
F. B. I. v. 554.
Upper Himalaya, Lahoul.

small, stem and branches 3-5 ins., tufted, succulent, smooth ; leaves $\frac{1}{2}$-$\frac{3}{4}$ in. long, round, ovate, tip rounded, margin toothed above the middle, rarely smooth, 3-nerved, base wedge-shaped, stalk $\frac{1}{2}$-$\frac{3}{4}$ in. long, stipules minute ; flowers minute, green sessile in clusters on the slender branches of stalked spreading, axillary racemes 2-4 ins. long, male and female flowers on the same plant, male sepals 4, stamens 4, anthers white; female sepals 3, unequal, stigma of a tuft of hairs ; carpel nearly round, minute, smooth.

Pilea umbrosa,
URTICACEÆ.
F. B. I. v. 556.
Himalaya, 4-9,000 ft.
Simla in shady places
(Collett).

large, hairy, leaves 3-5 by 2-3$\frac{1}{2}$ ins., ovate, broadly toothed, base wedge-shaped, tip tail-like, sharp-pointed, stalk 1-3 ins., stipules nearly persistent, large ; flowers as in the last species, but dorsal female sepal much the longest, achenes minute $\frac{1}{30}$ in., pale, with a raised intramarginal ridge.

Pilea scripta,
URTICACEÆ.
F. B. I. v. 556.
Himalaya, 4-7,000 ft.
Simla, in shady places
(Collett).

large, smooth, branched ; leaves 3-10 by 1-3 ins., lanceolate narrowed to both ends, tip tail-like, teeth small, shallow, stalk $\frac{1}{2}$-2 ins. long, stipules short ; flowers like the last species, carpels rough.

Elatostemma surculosum,

see Herbs, Prostrate, Opposite, Stipulate, Simple.

HERBS ERECT WITH OPPOSITE STIPULATE LOBED LEAVES.

PETALS UNUNITED.

Fagonia arabica or cretica,
Jowasa.
ZYGOPHYLLACEÆ.
F. B. I. i. 425.
The Plains.
Common in fields.
Rawulpindi.

small, annual, green, spiny with glandular woody branches ; leaves small one to three lobed, leaflets linear, short pointed, stalk often leaf-like, stipules of two spines longer than the leaflets ; flowers pale rose-coloured, small on solitary stalks between the spines, sepals 5, soon falling off, oblong-lanceolate, half the length of the petals, petals 5, closed, soon falling off, stamens 10, style and stigma undivided ; capsule velvety, 5-cornered, 5-celled, two seeds in each cell.

Fagonia Bruguieri,

see Herbs, Prostrate, Opposite, Stipulate, Simple.

HERBS ERECT WITH OPPOSITE STIPULATE LOBED LEAVES.

PETALS UNUNITED.

Geranium pratense, Cranes Bill, GERANIACEÆ. F. B. I. i. 429. Kashmir, 7-10,000 ft. The Chor near Simla.	medium size, stout, rootstock perennial, joints swollen, hairs spreading ; leaves 2-3 ins. diam., sometimes alternate, round, cut into 7-9 segments, short-pointed, stalks long, stipules small, lanceolate ; flowers 1½-2 ins. diam., blue-purple in pairs on axillary bracteate glandular and hairy stalks, sepals 5, long-tipped, petals 5, stalked, alternate with 5 glands, spreading, stamens 10, 5 long alternating with 5 short, filaments flattened, narrowed upwards, united below, styles 5 ; capsule 5-lobed and-celled, cells one-seeded, the capsule and styles elongate, the styles curl up with a jerk, ejecting the seeds.
Geranium rectum, GERANIACEÆ. F. B. I. i. 429. Kashmir.	medium size, rootstock stout, perennial, stem slender, slightly hairy and leafy ; leaves 3-4 ins. diam., 5-angled, 7-lobed, divided to below the middle, lobes sharp-pointed, thin, slightly hairy on both surfaces, long-stalked, stipules lanceolate ; flowers 1¼ in. diam. on long stalks, bracts awl-shaped ; the other characters are like those of the last species.
Geranium collinum, GERANIACEÆ. F. B. I. i. 429. Kashmir.	small, woolly or glandular-velvety, stems many unbranched, flowering 6-10 ins. high ; leaves sometimes alternate, round, 5-7-lobed to below the middle, segments wedge-shaped, blunt, 3-5 lobed, stipules small, ovate, short-pointed, flowers and capsule like *G. pratense* above.
Geranium palustre, or grandiflorum, GERANIACEÆ. F. B. I. i. 430. Kashmir.	very like the last species, but taller with large flowers 2 ins. diam. ; leaves 5-angled with 5 lobes cut pinnately.
Geranium Wallichianum, GERANIACEÆ. F. B. I. i. 430. Himalaya, 7-11,000 ft. Simla (Collett). Murree (Douie). Hazara (Barrett).	large, perennial, hairy, root thick, stem stout much branched ; leaves 3-4 ins. broad, 5-angled, deeply 3-5 lobed, segments long-pointed, sharply toothed, stalked, stipules ½-1 in. long, very broad, blunt ; flowers blue purple, 1½-2 ins. diam., on long stalks, bracts large, sepals 5, ending in a long bristle, petals 5, tip broad with a shallow notch, stamens, styles and capsule like *G. pratense* above.

Herbs erect with Opposite Stipulate Lobed Leaves.

Petals Ununited.

Geranium Tuberaria,
GERANIACEÆ.
F. B. I. i. 431.
Kashmir.

medium size, slender, hairy and glandular, root tuberous, perennial ; leaves $1\frac{1}{2}$-3 ins. diam,, sometimes alternate, round kidney-shaped, divided into 5-7 parts, segments very spreading, much divided, redical leaves long-stalked, stipules variable ; flowers 1 in. diam. in nearly umbelled clusters of 2 surrounded with shortly stalked leaves, main flower stalk very hairy and glandular, bracts leafy, much divided, sepals 5, small, blunt with a fine abrupt point, petals 5, large, rounded with a notch, stamens 5, filaments slender ; capsule $1\frac{1}{4}$-$1\frac{1}{2}$ ins. long, erect, hairy, styles very short, the beaks do not separate as in other species.

Geranium Robertianum, Herb Robert,
GERANIACEÆ.
F. B. I. i. 432.
Himalaya, 6-8,000 ft.
Kashmir, Narkanda (Collett).
Murree (Douie).

medium size, annual or biennial, softly hairy, usually glandular and strongly scented, often red, stem 1-2 ft. high, succulent ; leaves 1-3 ins. broad, triangular oblong, cut to the base into 3-5 pinnately lobed segments, central segment longest, lobes short-pointed, stalk long, stipules ovate, $\frac{1}{4}$ in. long ; flowers $\frac{1}{2}$ in. diam., red pink streaked with white in two flowered clusters on long stalks, sepals 5, broad, long-pointed, petals 5, narrow, smoothly stalked, twice as long as the sepals, not notched, stamens 5 ; capsule $\frac{3}{4}$-1 in. long, beaks separating upwards and attached above by silky hairs.

Erodium ciconium,
GERANIACEÆ.
F. B. I. i. 434.
N.-W. Frontier Province.
Kohat.

small, annual, velvety and sticky, branches stout, swollen at the joints ; leaves ovate, cut into two or three segments, segments divided into small toothed lobes, stipules ovate-lanceolate, long-pointed, thin, dry ; flowers small, purple on long two-to many flowered stalks, bracts thin, dry, finely hairy with an abrupt point, sepals 5, ovate thin with 3 glandular hairy nerves, ending in a long bristle-like point, petals 5, alternating with glands, broad at the tip, stamens 5, alternating with 5 staminodes, in other characters like *Geranium pratense* except the beaks being pitted at the top and the styles silky on the inner surface.

HERBS ERECT WITH OPPOSITE STIPULATE LOBED LEAVES.

PETALS UNUNITED.

Erodium malacoides,
GERANIACEÆ.
F. B. I. i. 435.
The Plains.
Attock, Peshawaur,
Hazara (Stewart.)
Rawulpindi.
Kot Fateh Khan (Douie).

small, annual, softly hairy, stem erect or widely spreading ; leaves ovate oblong, blunt or sharp-pointed, velvety, cut into three lobes only, not again subdivided, stipules large, thin, dry, blunt or sharp-pointed ; flowers small, lilac on three-to many flowered stalks, bracts ovate, thin, dry, finely hairy, sepals 5, thin, two outer 5-and three inner 3-nerved, the bristle point hairy, petals 5, tip broad, 9-nerved, stamens 5 with 5 staminodes ; carpels stalked, 3-angled, beaks 4-5 times as long as the cell, with stiff brown hairs for $\frac{1}{4}$ of its length, pits on beaks with a deep fold.

Cannabis sativa, see Herbs, Erect, Alternate, Stipulate, Lobed.

(*To be continued.*)

REVIEW.

THE RHOPALOCERA OF JAVA (*PIERIDÆ*).

BY

M. C. PIEPERS AND P. C. T. SNELLEN.

This volume is the first of a projected series; it is based on the work of the first author, an official in Java, who collected there for many years.

The authors have apparently used English as their medium, without having a sufficient acquaintance with it; sentences framed in German or Dutch and rendered imperfectly into English, make text which is not clear and the proof-correcting has been very imperfectly done. The introduction deals with certain biological subjects; the author states clearly that he is a determined opponent of the mimicry theory, that the phenomenon of evolutionary atrophy in *Lepidoptera* is neglected, that what he calls colour evolution proves the last statement, that the usual conception of dry and wet season forms is erroneous and finally that the hindwings of butterflies are disappearing in the process of evolutionary atrophy. He refers to the varying development of the anal horn of *Sphingidæ*; stating his belief that it is in process of disappearance by evolutionary atrophy, equally he believes the prothoracic wings of some insects have existed and disappeared, that in *Rhopalocera* the fore-legs are going, that the hindwings are getting smaller, " while, probably by correlative influence", the size of the fore-wings and the " whole corporal size of the Rhopalocera is strongly diminishing." Finally the pigments of the wings of Rhopalocera are paling and there is a tendency to the production of more black scales and so a darkening of the whole wings. The author expresses strong opinions in regard to the late de Nicéville's views on wet and dry season forms and mentions " the wild exaggeration of now-a-days in this respect". To most Entomologists, the author's opinions, backed by no definite observations or research, will carry little weight and the value of the work is not increased by the discursive introduction in which such novel views are put forth, an expression apparently of the author's peculiar point of view.

A total of 33 Pierids are listed as from Java and the author brings together the recorded facts as to life-histories. It is perhaps typical of modern entomology that the authors cannot accept the usual generic or specific designations and that to use the volume one must first look up the synonymy and ascertain what species, as generally known, they are discussing. The genus *Leptosia* becomes *Xiphia*, *Pieris* includes species from *Huphina, Appias* and *Saletara* of the Fauna of India; the genus *Delias* becomes *Thyca*; the last is due to Snellen, with whom Piepers is apparently not in sympathy as he states " This genus is generally called *Delias*. But Mr. Snellen is of opinion that the systematist need not count with the names given by Hübner * * ." If entomologists who publish such works would agree, all could use them with ease, but at present one has first to correlate the synonymy, no light task, before one can understand what species really are being discussed. *Iphias* is what the Fauna of India calls *Hebomoia*, *Callidryas* is our *Catopsilia* and so on.

For the student of Indian entomology, the work is of interest on account of its biological observations but the author's hostility to de Nicéville tinges it too strongly not to give rise to a feeling of distrust.

There are four beautiful coloured plates, in which larvæ, pupæ and butterflies not hitherto figured are beautifully portrayed. The authors have designedly given forth this family as a "proof" or model of what the whole series will be, in the hope of obtaining financial support. We fear the author's peculiar views and confusing nomenclature will make the series rank with other similar publications of great size and cost, which do little but add entries to cumbersome literature references without assisting towards a greater knowledge of the subject.

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

MISCELLANEOUS NOTES.

No. I.—NEW LANGURS FROM THE INDIAN EMPIRE.

In the Annals and Magazine of Natural History, Vol. 4, ser. 8th, September 1909, Dr. D. G. Elliot in a paper on "Descriptions of apparently new species and sub-species of Monkeys of the genera *Callicebus, Lagothrix, Papio, Pithecus, Cercopithecus, Erythrocebus* and *Presbytis*" describes three new species of Langurs from within our limits:—

(1) *Presbytis melamera* obtained at Cadu Gaung, Bhamo, N. Burma, collected by L. Fea.

(2) *Presbytis crepuscula* from Mooleyit, British Burma.

(3) *Presbytis lania,* shot in the Chumbi Valley, Tibet, by Lt. F. Bailey and presented by the Bo. Nat. Hist. Society to the British Museum.

The types of the above are all in the British Museum.

No. II.—ON THE FOOD OF THE DESERT GERBILLE (*GERBILLUS HURRIANÆ.*)

In the *Fauna of British India* (Mammalia) Dr. Blanford remarks that the Indian Desert Gerbille (*Gerbillus hurrianæ*) "abounds in sandy desert or semi-desert, and is particularly common in Sind" and "it is commonly seen out in the day, in the cold season at all events, and is by no means shy." There is plenty of such country round Karachi, and it is very pretty to watch these attractive little field rats round their burrows. Their diurnal expeditions are however by no means confined to the cold season, as they are out and about the whole year round, and on the absence of shyness, I can more than confirm Dr. Blanford's remark, in fact I would go so far as to describe them as bold. Watching a community of them this morning from behind a bush at some fifteen yards distance, I walked boldly forward into the open to investigate a wasp that was circling round some plants near them. There was naturally a sudden disappearance of the gerbilles, but as I approched, the heads and shoulders of two appeared again at the mouth of a hole not three yards before me. I stopped, and they shewed no signs of alarm, for they—a mother and half-grown young one—proceeded to fondle each other, licking one another's faces in the most affectionate manner. On returning towards the bush I turned and sat down in the open, not ten yards from the burrows, and as I did so there were already half a dozen of them outside their holes. One cannot help admiring one's jungle friends in such close proximity, but in doing so one is liable to receive bitter shocks to one's feelings. On this occasion one was in store for me, for I saw a full-grown gerbille scuttle away some distance and return with a large lump of some dark stuff in its mouth. I had seen where he had gone for it and went up to ascertain its nature. It proved to be a dry piece of human excrement! I again returned to my post of observation ; in a few moments the gerbille reappeared and proceeded to demolish his unsavoury meal. We must always be prepared to modify our opinions when we come to pry into the inner life of wild animals, but the process of doing so does not always add to our respect for our jungle friends.

E. COMBER.

KARACHI, 15*th August* 1909.

No. III.—TIGER ATTACKING A BEAR.

I do not ever remember to have heard of a Tiger attacking a Bear, until last cold weather, when shooting in the Central Provinces. When making inquiries of an old *Karmar,* who spent his life in fishing and hunting, regarding the game to be found in the district, he casually remarked that a lame bear used to frequent a certain part of the jungle, but that it had quite recently been killed and eaten by a tiger. He was quite positive of the fact—in support of which he advanced the evidence that he found the partially devoured remains of the bear in the bed of the river and the sand showed ample evidence of there having been a fierce struggle between it and a tiger which in the end had come off victorious and made a meal off his foe ! A few days afterwards when passing the spot he pointed out some of the bear's hairs lying scattered about the place—the carcase having been cleared away by animals. He said the bear was a large one, but for a long time past—for he had often seen it in the neighbourhood—he had noticed that it was lame. I had no reason for doubting the man's words, but the incident was certainly a very unusual one.

L. L. FENTON, LT.-COL.

4*th October* 1909.

No. IV.—A FIGHT BETWEEN A HYÆNA AND A PANTHER.

"In March 1908, a party of Royal Artillery Officers from Secunderabad had a drive for tiger in the Mahadapore Taluka in His Highness the Nizam's Dominions near the village of Somnapally some 16 miles off the Godavery. A tiger came out first and was bagged, shortly afterwards a panther came out and received a flesh wound in the neck, after which it disappeared into a deep cave. This was surrounded; and they soon heard the noise of a fight going on inside spelling fighting, roaring, etc. The shikaries said that there was a tiger in the cave which was killing the panther ; the officers tried for half an hour to dislodge the animals by firing rifles and throwing fireworks into the cave but without success. So leaving the officer who had wounded the panther on guard, the other two went off to secure the dead tiger. Shortly afterwards a small hyæna came out and was shot. The hyæna was a female about 4 feet 6 inches in length and was somewhat badly scratched about the face but otherwise uninjured. Next morning on returning to the cave a female panther, about 5 feet 10 inches, was found lying just outside the cave stone dead. On examination it was found that she had a flesh bullet wound in the neck, which was not sufficient to kill her, but she had been bitten in two places by the hyæna, firstly through the loins, secondly through the kidneys and at the same time injuring the spine, and there is little doubt that the panther died from these injuries as the flesh wound in the neck was not nearly severe enough to cause its death, although it might have done so in a few days if mortification had set in."

The above gives us some reason to doubt if the gentlemen, one reads of who pull hyænas out of caves by the hind legs, were not luckier than they knew.

W. M. F. PENDELBURY.

JALNA, 26*th October* 1909.

No. V.—MOTTLED POLECAT (*PUTORIUS SARMATICUS*) AT BANNU.

An example of the Mottled Polecat (*Putorius sarmaticus*) was recently sent me by Mr. Harris, Assistant Commissioner and Political Agent, Bannu. It had been caught by Bannuchi Zemindars about three miles from Bannu in sugar-cane crops.

Mr. Harris informs me that this is the second example brought to him by the natives, the first having been caught in a desert tract under the hills; so the species is, possibly, not very rare in this district.

The one sent me I now have in captivity. It does not appear to be quite up to the measurements given in the "Fauna," and may be an immature specimen. It differs from the "Fauna's" description in having the muzzle and chin white and the back of the head and nape a brownish white.

In habits it is sluggish and disposed to sleep all day, but at night becomes active, running up and down its cage and tearing at the wire netting with teeth and claws. When suddenly disturbed, by day, it becomes savage and utters a growling noise, very similar to that of a fox-terrier pup of a few weeks old when irritated.

It thrives on raw meat and milk, and dead birds are especially appreciated being devoured bones and all. A live quail introduced into its cage, by day, was not touched; in fact, if anything, it appeared afraid of the intruder. I have not yet been able to secure a live rat with which to further test its killing propensities.

H. A. F. MAGRATH, MAJOR.

BANNU, *September* 1909.

No. VI.—A GOOD HEAD OF HODGSON'S WILD SHEEP.

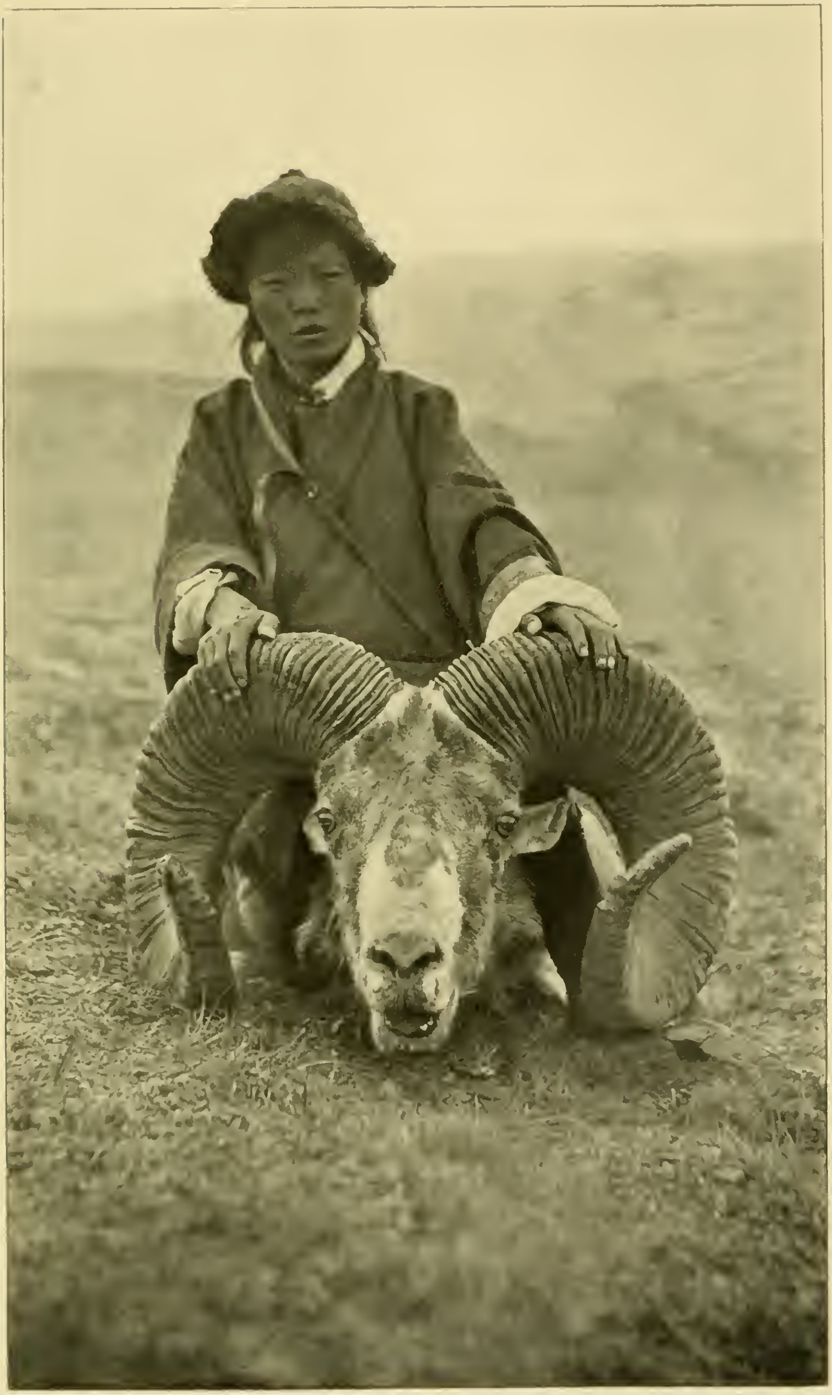
(*With a Plate.*)

I send you a photograph of the head of an *Ovis ammon hodgsoni* which was shot at Dochen in Tibet in July 1907. The following are the measurements of the horns:—

LENGTH.		CIRCUMFERENCE.	
Right.	Left.	Right.	Left.
45½″	49″	19″	19″

F. M. BAILEY.

GYANTSE TIBET, *April* 1909.



Head of *Ovis ammon.*

No. VII.—THE SEROW.

I see in our journal, Vol. XIX, No. 2, on page 519, among the Miscellaneous Notes, one (No. IV) by H. Shaw Dunn on Serow.

He says he does not think that the rufous variety exists in Upper Burma. Allow me to assure him that he is absolutely wrong, in fact I believe the rufous variety is the only variety which exists in the Upper Chindwin.

I shot a Serow within 4 miles of Teslin in the Gangaw Sub-division—an old male—rufous-red all over except for a black mane and tail and a black line running along the length of his back. Also two some 60 miles further north, one on the Nwaydoung—rufous-red—being a female the line along the back not black but only a darker colour than the rest of the body, and one 10 miles from here, a small male of the same colour as the first above described.

I saw a Serow killed by wild dogs in the Lomegtoung, also one killed in the same way some 140 miles north in the Mytha river and not more than 20 miles from Kalewa. Both were rufous-red, and you could no more have called them black than you could white.

I had one of those I shot set up (head and neck) and I fancy Mr. Dunn would alter his opinion were he, at any time, to pay a visit to Spencer House, Stansted, Essex, where the head is now and where it would be shown him with pleasure.

I am well aware that the black variety exists in most parts of Upper Burma, and I believe it is the only variety in the Ruby Mines; but that the rufous variety also exists, there is no doubt. I saw a specimen of the black in Mogok, set up head and neck, and could not at first believe it was shot in Burma, so much did it differ from those I had seen and shot.

C. B. MOGGRIDGE,
Ruby Mines District.

MANDALAY, *November 2nd*, 1909.

No. VIII.—HABITS OF THE TAKIN.

In connection with the recent arrival of the young Bhutan Takin in the Zoological Society's Gardens, the following notes on its Chinese cousin, taken from a letter written to me from Chentu, Sze-chuen, on 9th October 1908, by the late Mr. J. W. Brooke, will be of interest, as very little has been previously recorded regarding the wild life of these curious ruminants. After referring to the great difficulty of approaching the animal, the writer states that in Sze-chuen the Takin inhabits dense bamboo and rhododendron jungle on extremely precipitous hillsides, where it is nearly always pouring with rain. The elevation of these jungles is from 8,000 feet to 10,000 feet above sea level, and here the males are to be found from October to May, except when driven down by stress of weather. The females, on the other hand, descend to the valleys during March, April and May to feed and rear their young. These are suckled only for a fortnight after birth and very speedily become as active as their parents, as is evident from their tracks, which may be seen in the most precipitous situations. So steep, indeed, is the ground on which Takin of all ages are usually found that Mr. Brooke was of opinion that they must aid their ascent by hooking on to the rhododendron branches with their horns as he could not otherwise imagine how they negotiated the smooth, steep places on which their tracks may be seen. This, however, requires confirmation by actual observation before it can be definitely accepted.

Takin go about, says my correspondent, in herds of from five to about fifty head, and, according to the reports of native hunters, when a herd takes to headlong flight all its members will follow the line of their leader, who may even leap over a precipice. Old males are stated to attain a huge size, Mr. Brooke mentioning that some of the tracks of their great clumsy hoofs are 6 in. square. For a considerable part of the year they separate themselves from the main herds which consist of females and young males. Here it may be mentioned that information supplied to me by Capt. Malcolm McNeill confirms the conclusion reached from the study of the specimens in the British Museum that young females are much greyer than males of the same age.

The best time to shoot Takin, observes Mr. Brooke, is in winter, when the heavy snow compels them to come down to the valleys; but as the snow is soon melted by the warm winds blowing from the plains, they are only to be found low down during unusually long and heavy snowfalls. Throughout the winter they will always be found on the wander, as if never contented with a single grazing ground; and if not found low down in the valleys are almost impossible to hunt successfully. It will be observed that nothing is said by my correspondent as to the whereabouts of the Takin from May till October, but I presume that Mr. Brooke referred only to the period during which he was on the ground, and that, except for the aforesaid temporary descents, they haunt the bamboo and rhododendron jungle throughout the year, unless it be that they go still higher in summer.

As regards the young Bhutan male in the Regent's Park Zoological Gardens the straightness of its horns gives it a much greater resemblance to a Serow than is presented by older animals, when the horns have acquired their characteristic curvature. With its conspicuous broad dark dorsal stripe, the animal looks, indeed, by no means unlike a light coloured "sport" of the Nepaulese race of the Sumatran Serow; and I have little doubt that the two animals are nearly allied. In its present condition, at any rate, the colour of the coat of the Bhutan animal is very different from that of either the male or female of the older pair of the Sze-chuen species exhibited in the lower mammal gallery of the Natural History Museum.

R.

(*From " The Field"* of 31*st July* 1909.)

No. IX.—A GOOD CHINKARA OR INDIAN GAZELLE HEAD.

In May 1909, Captain J. Hodgkinson, 5th Cavalry, shot a Chinkara, (*Gazella bennetti*) near Montgomery, Punjab, with horns measuring 15¼ inches in length and 5 inches in girth. The horns were measured by myself with a steel tape while still fresh and in the hands of a taxidermist in Meerut. I have not heard of any Chinkara head larger than this and doubt if such has been obtained.

R. M. BURTON, MAJOR, I.A.

MEERUT, 11*th September* 1909.

[According to Rowland Ward's *Records of Big Game*. the record Indian Gazelle head measures 15⅝ with a circumference of 4¾ inches. It belongs to Major P. C. Palin. Another head of the same length but half an inch smaller in girth was killed at Ferozepore and is in the Mess of the 14th Sikhs.—EDITORS.]

No. X.—THE WALL CREEPER (*TICHODROMA MURARIA*) IN LYALLPUR.

I am sending a bird I shot last weather in this district (Lyallpur) for identification. I first saw it in June at this place, Kotkhudayar. It spent its time flying round the buildings here, which are all of bricks, and clinging to the sides of the walls where it seemed quite at home. It was alone and made a plaintive cheeping noise which was repeated at intervals throughout the day. I saw it at this bungalow for about four days when it disappeared. About three or four days later I had occasion to go to a bungalow of mine which is about 18 miles from here when I saw the same bird again. At least I believe it must have been the same. I shot it and have kept its skin. I have not seen any more here since. If the skin is of any use to the Society you may keep it.

A. B. AITKEN.

KOTKHUDAYAR P. O.,
Via CHINOT ROAD. *August* 18*th*, 1909.

[The bird sent is a Wall Creeper (*Tichodroma muraria*) and has not often been found so far south in India before. As a rule this species keeps to the hills and only descends to the plains during the cold weather. In India this species is found throughout the Himalayas and the hills of the frontier and has been recorded during the cold weather from Etawah, Bhutan, Doars and Dehra.—EDITORS.]

No. XI.—SEASONAL CHANGE OF PLUMAGE OF THE INDIAN WHITE-EYE.

In May 1901 I caught a White-eye (*Zosterops palpebrosa*) which was visiting my newly-built aviary to talk with some tame White-eyes I had. He had a bright chestnut forehead. I did not think much of it at the time as I did not then well know this bird from a book point of view, though well acquainted with it alive both wild and in captivity. He died soon. Not long after, I looked up the book and was astonished to find no mention of a chestnut-foreheaded White-eye nor of a seasonal change of plumage. Till this year (1909) no other similarly coloured ones have been observed by me, though I must confess that I did not particularly look out for them and that in some years I had no opportunity of observing White-eyes at all.

About mid-April this year I noticed several with chestnut foreheads, and pointed this out to my bird friends in the Regiment, Major Sealy, a very keen observer and field naturalist and Mr. Kennedy a fellow aviculturist. Wanting a couple of pairs for my aviary I set a "drop-net" near a flowering shrub the birds visited and soon had a bird. I was rather disappointed to find the forehead only rusty coloured. I put it down as a hen, correct but a fluke. Her mate (or rather a mate) was caught the next day, and he had a fine chestnut forehead. The hen died at once ; it is a bad season to "meat off" in and I determined to wait for others till autumn if the cock died. He did not die, so about 1st May I set the net again and caught ten in under two hours and could have caught more. All these and the others flying about uncaught had bright chestnut foreheads. In fact about this time I saw none that were not coloured in this way. In plumage the sexes were indistinguishable, but I found that I had five pairs. With the aid of a four-compartment wire cage I separated out two true pairs and let go the rest. I am pretty certain that these birds had not then started nesting, though there were several nests lower in the station.

I left the station to go further up the hill where there are no White-eyes, on 26th May ; by that time I noticed my White-eyes were losing their chestnut. I returned on 6th June. Mine had lost all colour, and the wild ones I saw had lost theirs, but Major Sealy told me that he had lately seen some "coloured" ones about. I went up the hill again on the 8th June, returning on the 20th June. I made a special search for coloured ones without success. A few days later Mr. Kennedy showed me a nest with young in his compound ; we watched the old birds feeding the young from a very short distance. They were normally coloured.

My five are as fit and as happy as their wild relations, but they remain common or garden Indian White-eyes (*Zosterops palpebrosa*) and charming as they are, of no special interest to any one but myself. Still I have hopes that they will attempt breeding next year.

Of course, I know that to make a good record one ought to kill and send down a skin. I plead laziness with a dash of sentiment. I make the record such as it is, as several things strike me as curious about it. The bird is a very common one, why has such a change not been recorded before ? I believe it has not been recorded. How was it that I noticed it in 1901 and then not again till 1909 ? I certainly did not keep a special look-out for it ; but the chestnut is very noticeable and I set to work to catch my 1901 bird on that account. Both sexes don the chestnut, but keep it such a short time. Men (and women) have been known to drop fine raiment soon after matrimony. Can one apply a similar reasoning ? Is it a species in the making ?

G. A. PERREAU, Capt., F.Z.S.,
4th Gurkha Rifles.

Bakloh, Punjab, *8th August* 1909.

No. XII.—SHRIKES' LARDERS.

On page 539 of Volume XIX of the Society's Journal, the writer, who reviews "Birds of the Plains," charges me with casting doubt on "the well recognised habit of the shrikes of storing their captures impaled on the thorns of bushes." He says that it is a pity I ridicule "such previously undisputed evidence." Finally he says "It is quite probable that some of the smaller shrikes have not the habit of impaling their victims in this manner, but the remarks (in 'Birds of the Plains'), are generalised for the whole family." Was ever a writer more misrepresented than I have been? What I did, and do, say, is that I have never set eyes upon such a larder, nor have I seen a shrike impale a victim. On the strength of this I added "I, therefore, think I am justified in suggesting that the habit of keeping a larder is probably restricted to the larger species of shrike." I further stated that I would esteem it a great favour if any one, who has seen a larder, would favour me with an account of it. Yet again, I said "Let me not be mistaken. I do not say that butcher birds never keep larders, for they undoubtedly do; of this I am satisfied."

But let this misrepresentation pass. The important point is the larder. The reviewer above referred to says that he has come across one. I am sure that most of the readers of this Journal would like to have an account of it, to be told in what part of the world it was found, to what species of shrike it belonged, what was the nature of the meat stored therein, whether, as the store of meat began to run low, it was replenished. I have never read an account of such larders in India, so that I hope that those members of the Society who have seen them will come forward. Owing to the ubiquity of crows and ants in this country, I should imagine that the butcher bird, that attempted to set up "shop," would find its hands pretty full in keeping its stock intact. I should be very glad to hear how the shrikes in question overcame the difficulty.

D. DEWAR.

ALLAHABAD, 6*th December* 1909.

No. XIII.—COMMON MYNA (*A. TRISTIS*) FEEDING YOUNG OF PIED MYNA (*S. CONTRA*) AND NESTING HABITS OF THE COMMON PARIAH KITE (*M. GOVINDA*) AND BRAHMINY KITE (*H. INDUS*).

The other day I saw a common brown myna feeding the young of the pied kind. A friend of mine also sent me the following interesting note some time back. Have you ever noticed that the ordinary kite—the brown one—picks up sticks from the ground to make a nest, whereas the Brahminy kite pulls them off the growing tree, so the sticks he uses are much smaller than those used by the other?

CHAS. M. INGLIS.

BAGHONIE FACTORY,
LAHERIA SERAI, P. O., 5*th November* 1909.

No. XIV.—CHANGE OF PLUMAGE OF THE CINNAMON TREE-SPARROW (*PASSER CINNAMOMEUS*).

I met this bird first in Chitral (1902-03), but only took skins in winter. Captain Fulton's were also winter skins. All mine were normal. In June 1906, I met this bird again in Kajiar, a little up in the hills in Chamba, one March, beyond Dalhousie. I put it down as *cinnamomeus* without considering the matter much.

In June 1907, I was trapping in Kajiar with a view to collecting birds to take home alive with me the following March. There were Cinnamon Tree-Sparrows in abundance, but to my disappointment I could see none with any signs of yellow on them, though there were numerous colonies nesting. I took away three nestlings, which turned out one cock and two hens, and an adult cock. They showed no trace of yellow. The adult cock had a fully developed bib and the back and head were a fine cinnamon; so it could not have been a bird of the year. The young take some time to reach this stage; my young cock had not attained this plumage fully when he died in March 1908. I certainly should have reported the occurrence of *P. rutilans* (or *assimilis*) but that I could get no skins. Since then I have learnt to mistrust my skin-procuring propensity.

Careful record was not kept of change of plumage, but by December 1907 all four birds "showed yellow" and bright at that. They were undoubted Cinnamons. Had the Kajiar birds showed even a far duller yellow I could not have helped noticing it, as I watched them pretty carefully. The yellow was duller by March 1908 and it was duller still when they went to Mr. Teschemaker in England in May.

The above is a summary of a paper by me in the Avicultural Magazine, Vol. VII, May number, 1909. In the same number, Mr. Teschemaker wrote a paper on the successful breeding in captivity of this species. I give extracts, taking only those which concern change of colour, about which I made mention to him before sending him the birds.

"Now, of course, I was anxious to put this matter to the test, and, as yellow is a colour not easily impaired by cage-life, I did not anticipate any difficulty in the matter, and only retained the young male for the purpose of observation."

"The adult male began to show his yellow breast about the middle of December, apparently through an actual change of colour and not by casting any feathers, and as an exhibitor offered to purchase a pair, and naturally wanted the best birds, I sent him this bird. As bad luck would have it it died shortly after arrival, and with considerable reluctance, I therefore gave him the remaining young male. I am unfortunately therefore only able to confirm Captain Perreau's observation to this extent: namely, that the adult male certainly had a bright yellow breast when I received it on the 4th May (though it had faded somewhat according to Captain Perreau, by that date); that by the commencement of July it's breast had become entirely grey, only the cheeks retaining the chrome colour; that by the middle of December there was every indication that the plumage of the former winter would be renewed. On the other hand, Captain Perreau tells us that the young male (which was ultimately killed by the adult male) also changed colour in December, and this I cannot confirm because I have made careful enquiries and, as lately as the 31st March it's present owner has informed me that there is no indication of any change."

"I am hoping that this matter may still be cleared up beyond any possibility of doubt, because Captain Perreau has just returned to India and will be able to obtain a series of skins, and on the other hand, I hope to be able to keep an eye on the birds which were bred in my aviary and record any change."

I hope he has been more successful with his records than I with my skins. As to my young bird, I find the following note about it's decease:—"Found dead in a box, probably worried by old cock, no mistake as to which it is, little yellow showing bib not quite developed, back and head less so."

He also gives the size of the eggs as being 72 mm. by 53 mm., and mentions the female "with her yellow cheeks and richly coloured and striated wings."

Cinnamons do not visit us here even in winter, worse luck, we get *P. domesticus*, var. *ind.* instead, and he seems to increase every year. I spent two "ten-days" further up the hill this year. I got no skins. I plead laziness with extenuating circumstances. At the first place they were rare and only met with when they were safe. There was no yellow on those I saw. In the second place (Kajiar) they were extremely common but—there was a "week" on. Afternoons and evenings were occupied and I rather begrudged giving up even a part of my mornings to skinning. Also a gun attracts more attention than a couple of "dropnets" and a small spring-net. I had not meant to do any trapping at all, but was rather glad to find the mornings free and still more glad that I had the above nets, not that they did much good for what I specially desired, *i.e.*, black and yellow Grosbeaks and Cinnamons. I spent three mornings at the latter in a place that had been used by transport mules at the start of the "Camp," and which simply swarmed with these sparrows. They were uncommonly cheeky and tame, but would have nothing to do with my nets. I saw only two with yellow, old cocks, both had nests close with young. They were practically in sight all the time; the yellow was not over bright and was confined to the cheeks or may be sides of the neck. I saw hens (and cocks too for that matter), feeding young at a distance that any yellow even of the palest ashy would have been easily discernible even without glasses.

I met with a few in Dalhousie on the way through, some with nests in the houses I visited No yellow except on one cock, which was coloured like the Kajiar yellow cocks.

Oates describes the hen as having the whole lower plumage pale ashy yellow. He describes the cock of *P. rutilans* as only differing from that of *P. cinnamomeus* in having "the cheeks and ear-coverts pure white and the lower plumage ashy-white without a trace of yellow." He continues "the females of the two species are indistinguishable."

In my birds the ear-coverts and cheeks of the cocks "out of colour" were ashy white rather than pure white and the lower plumage of the hens (especially the upper parts of it if I remember rightly) deserved (when in colour) a higher attribute to the yellow than pale ashy. I have a kind of recollection that my Chitral hens were distinctly yellow underneath, but one cannot count much on memory for so many years back, unless the reminiscence is backed by some special reason. Bright "reds" in the cock often find their counterpart in yellows in the hen, but surely it seems curious (with passerine birds) that such a dingy colour as ashy grey (in the cock) should be replaced by pale ashy yellow (in the hen). I own to not having seen *P. rutilans*, alive or dead.

This is a good deal longer than I intended, but I hope that colour theorists at any rate will find something of interest in it.

G. A. PERREAU, CAPT., F.Z.S.

BAKLOH, PUNJAB, 30*th August* 1909.

No. XV—THE NESTING OF A FEW SOMEWHAT RARE BIRDS NEAR MHOW.

THE INDIAN PITTA (*Pitta brachyura*)—When going down the ghats, near Mhow, in July 1908, I came on this beautiful bird. I knew, therefore, it must be breeding and I determined to find its nest. I had an idea that this was located low down in brushwood. It was not, however, till June 1909, that I proved successful. My happy hunting ground is a bit of level ground, very glade like in appearance, at the bottom of the ghats, *viz.*, tallish trees, slight undergrowth but not sufficient to impede one's view early in the monsoon, but later very rank and thick. The Pitta is a very shy bird and does not give one much time to watch him. I knew there were a certain number in this particular locality, as I had seen them flitting about, but how many pairs there were I never could settle.

My method of birds' nesting is to mark down the nests while being built. I know more or less when the season of the various birds come round. I then watch them. If nesting one very soon spots it by watching, it is not long before the nest is betrayed. I have pursued this system with marked success. The great advantage of it is that one gets fresh clutches.

It was my intention to follow this practice with the Pittas. I visited my happy hunting ground on two consecutive Sundays early in June, and met with success. On these occasions, I left the Pittas alone, as I fancied they did not breed till July. On the 27th June, having collected eggs from several nests, marked down the previous Sunday, I turned my attention to the Pitta, and told my orderly, who accompanied me to keep a sharp look-out. I had not proceeded very far when I saw an untidy mass of twigs on the fork of a teak tree, with absolutely no concealment, about 12 feet off the ground. I did not think much about it, but as it was so accessible, I told my orderly to go up and investigate. To my intense pleasure and surprise, as he began to climb, out flew a Pitta, and my search was rewarded. The nest contained 6 partially incubated eggs. I had the nest taken down and examined it. First, a mass of sticks is collected forming a foundation, on this the nest proper is built up. It is compact and domed, oval in shape, with the entrance at one side. All the material is welded together, skeleton leaves being largely employed. The interior is neatly finished off and lined with roots, grass and such like. The whole structure is about the size of a man's head and placed, as those were that I found, on a bare fork, they are not difficult to see. On the same day, my orderly found another nest, similarly situated, but some 30 feet up. This also contained 6 partially incubated eggs. On the 4th July, I found two more nests containing 3 and 4 eggs, respectively, which I left; while on the 11th July, I got 5 eggs from them, and found another containing young, and another, I think, being built. The hen sits close and only moves when the climber approaches. The nest really looks like a collection of old sticks, and does not give one the impression of being in use. I am recording this rather fully, as the record in "Nests and Eggs" is so different. Possibly the bird's habits differ in accordance with locality.

THE BROWN FLYCATCHER (*Alseonax latirostris*).—The breeding of this bird has been reported before from Mhow. I only write to confirm its occurrence. I found it very common on the ghats and discovered its nest by luck. I was watching a Southern Yellow Pit (*Machlolophus haplonotus*) building, when a little brown bird flew over me and settled on a bough, on noticing it I found it was building. Once the bird's habits are known, the discovery of the nest is easy. It is usually situated some 20 or more feet from the ground, being compact and cup-shaped, a typical flycatcher's nest. Four eggs seem to be the complement. I took nests on the 20th and 27th June and 11th July.

THE BLACK BUNTING (*Melophus melanicterus*.)—Very common on the ghats, but I did not get many nests, as I looked in the wrong places. I seldom came on this bird building. It affects two sites, one well concealed under leaves and grass, the other unconcealed alongside roads, in steep cuttings. When I discovered the latter fact, it was too late, for though I found many nests, the young were there or had flown.

THE CUCKOO (*Cuculus canorus*).—I have already reported that the Cuckoo is very common on the ghats here during the monsoon. I had the pleasure of getting an egg this year from the nest of the Black Bunting (*Melophus melanicterus*). On the 13th June, I found this bird building. The nest was well concealed among some dry leaves on the ground. I visited the nest again on the 20th, when I found it contained one Bunting's egg and one of the Cuckoo.

THE PARADISE FLYCATCHER (*Terpsiphone paradisi*).—I found several nests of this beautiful flycatcher. I fancy if I had laid myself out I could have found many more. Most nests were within hand reach. I saw no birds in white plumage.

THE PAINTED SAND-GROUSE (*Pterocles fasciatus*).—I found a nest with 3 fresh eggs, which unfortunately got broken, on the 17th February 1909, in some forest land. No nest to speak of.

THE LARGE GREY-HEADED FISHING EAGLE (*Polioaetus ichthyaetus*).—On the 23rd October, I saw a pair of these birds on a very large jhil, some 30 miles from this. They were very noisy, which attracted my attention. I noticed they were building and saw them "in copula." The nest was placed on the very top of a fairly large tamarind tree, on a small island. I did not go up to it, but from below it appeared to be a huge massive platform of sticks. I sent my orderly out on the 7th November, when he obtained 3 beautifully fresh eggs. He told me the birds were very bold, that he had to take up a man with a long stick to ward off their attacks. This is the only occasion I have noticed these birds round here.

R. M. BETHAM, LIEUT.-COL.,
The 101st Grenadiers.

MHOW, C.I., *9th November* 1909.

NO. XVI.—BIRDS' NESTING IN GARHWAL.

The following notes of some nests obtained at the snows this year may be of interest to some of your readers.

THE SNOW PARTRIDGE (*Lerwa nivicola*).—I found four nests during June at between thirteen and fourteen thousand feet; five appear to be the full clutch, and eggs were hard-set by the end of June, newly hatched chicks being seen early in July. The nests were all placed under overhanging ledges and were pretty well lined with moss and leaves; they are well concealed and the bird sits very close, but the cock-bird rather gives away the nest by calling and strutting about in its vicinity, however they take a lot of finding even then. The eggs are decidedly large for the size of the bird, measuring 2·2 by 1·43 on an average. In the "Birds of India" the ground colour is given as white; but out of 18 eggs there is only one that can be described as white, the ground colour in all the others being a pale *cafe-au lait*, and they are rather sparingly speckled and spotted all over with reddish brown, much resembling (except in being narrower) some eggs of the Koklass pheasant.

THE WHITE-WINGED GROSBEAK (*Pycnoramphus carneipes*). Several pairs of these birds were first observed at about eleven thousand feet, and they gradually moved up to fourteen thousand and there we marked down two nests and got three fresh eggs from each on June 28. One nest was in a birch about fifteen feet up, and the other about six feet up in tall bushes of juniper. Both nests were precisely similar and very curiously made, there being a sort of outer fence of prickly twigs, then twisted grass and the inner lining being entirely composed of strips of juniper bark. They were very wary and took a long time building. I first saw the females carrying grass on June 11

I believe these birds have been found breeding at Kohat by Mr. Whitehead, but I do not think they have been recorded from these parts before. The eggs measure 1 inch by ·7 and are greenish grey, spotted and scrawled with purplish black and with pale purplish markings.

WALL CREEPER (*Tichodroma muraria*).—I found a nest in a boulder cliff at twelve thousand feet, but they were feeding young on June 12, and the young birds left the nest on June 27, when I secured one of them. The nest was nearly two feet inside wedged between two boulders and was a pad of wool and hair and grass.

THE RED-HEADED BULLFINCH (*Pyrrhula erythrocephala*)—One nest was taken at about twelve thousand feet, it was placed ten feet up in a small tree and was made of thin twigs and beard moss (*Usnea barbata*) and lined with rather coarse roots. There were four fresh eggs on August 28, they measure ·81 by ·56 and are a very pale greenish white, marked chiefly at the larger end with pale purple and dark reddish brown. These eggs differ from those of the European bullfinch in being very much paler in ground colour, and eggs of *Pyrrhula aurantiaca*, taken by Col. Ward in Kashmir, are pure white in ground colour and are very sparingly marked with reddish brown.

THE ORANGE-BARRED WILLOW WARBLER (*Phylloscopus pulcher*)—This bird was fairly common at thirteen thousand feet, but many nests were destroyed by some bird or animal and only two clutches were secured. In one of these clutches three eggs were unspotted white and the fourth had one single blotch of pale brown only, so it would seem that *pulcher* occasionally lays white eggs: all I have seen before were spotted with red. I have recorded this bird as nesting before, up the Bhagirathi Valley.

PINK-BROWED ROSE-FINCH. (*Propasser rhodochrous*).—Several nests were taken at twelve thousand feet in the latter half of August; they were placed low down in bushes and made of moss and dry grass and lined with hair. The eggs are rather a dark blue with a few black spots and occasional hair lines. I found the Himalayan Ruby-throat (*Calliope pectoralis*) and the Blue-fronted Redstart (*Ruticilla frontalis*) breeding freely at twelve thousand feet and upwards in the Niti Valley, and saw numbers of their nests. In "Nests and Eggs of Indian Birds" the eggs of these birds, both of which breed in precisely similar localities, appear to have got transposed; it is *Calliope* that lays the greenish blue eggs and *Ruticilla frontalis* the salmon-buff egg, *Calliope* lays sometimes unspotted eggs and sometimes faintly spotted with pale red, its nest is usually domed and is made entirely of dry grass. I only once saw a few burhel hairs used. *Ruticilla* builds with moss and grass and lines thickly with hair and wool. I was unable to secure the eggs of *Grandala cœlicolor*, though I am inclined to think they were commencing to pair towards the end of June. They moved up to over sixteen thousand feet, and there we twice saw a female apparently prospecting under rocks, but I had to leave those parts.

JEOLIKOTE, 20*th October* 1909. S. L. WHYMPER.

No. XVII.—BREEDING OF THE MASKED WAGTAIL (*MOTACILLA PERSONATA*) IN KASHMIR.

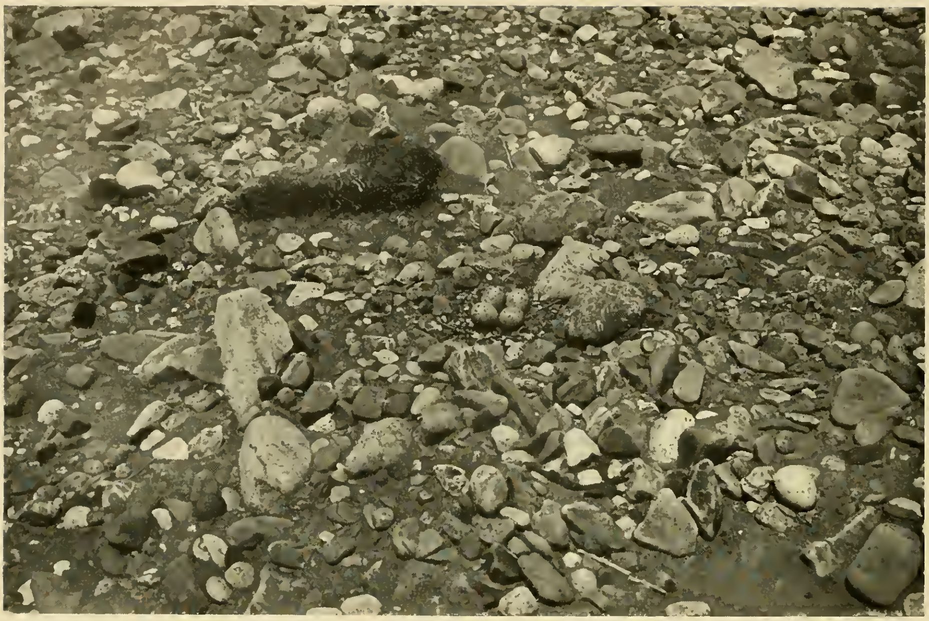
In his list of birds of the Province of Kashmir, Col. Ward remarks on page 723, vol. xvii, No. 3, of the Society's Journal, that this bird breeds at elevations of about 6,000 ft. to 8,000 ft. in Kashmir, and probably in Baltistan. In the 2nd edition of "Hume's Nests and Eggs of Indian Birds," it is recorded that Major Wardlaw Ramsay found the bird breeding in Afghanistan throughout May and June, and mention is made of one of the nests he found being placed *in a recess under a large stone* near the edge of the water, and again in Oates' "Fauna of British India"; it is stated that the eggs have not been described. It seems, therefore, worth my recording that last year (1908), towards the end of June, I found a pair of these birds building close to my tents at Aroo, in the Siddar Valley, Kashmir, elevation 9,000 feet. After watching the birds carrying away bits of grass, etc., I discovered the newly commenced nest in a 'kulmanch' (*Viburnum fatans*) bush about two feet above the ground, and 100 yards or so away from water. The bush was isolated with open ground all round and over and over again I saw the birds fly into it, while the building was in progress. Before I left the camp, only one egg had been laid, so leaving it I later on sent for the nest which then contained 5 eggs. The nest was a fairly deep cup built of grass roots for a foundation and thoroughly well padded inside with hair wool and bits of cotton, etc., picked up round the camp The eggs are very freely speckled with small dusky spots; especially so at the larger end.

20th September 1909. L. L. FENTON, COL.

No. XVIII.—A NOTE ON THE NESTING OF THE BESRA SPARROW HAWK (*ACCIPITER VIRGATUS*) AND THE ANDAMAN NIGHTJAR (*CAPRIMULGUS ANDAMANICUS*) IN THE ANDAMANS.

House crows not having yet been sentenced to transportation, an untidy collection of sticks in the fork of a rain tree, although overhanging a road to a small village, attracted my attention early in March this year. it contained nothing. but was noted for future inspection. On the 21st March I visited the spot again and found it contained two fresh eggs of the Besra Sparrow Hawk, thinking this was probably the full complement for the Andamans, as birds who should know better often play this trick on collectors here, I took them, but secured another egg in the nest on the 25th, my first piece of good fortune.

The jungle round here was a favourite hunting ground of mine, and I had placed nesting boxes for the Andaman Shama in it. I had also noted another stick nest in a rain tree not 100 yards away from the nest I had taken the Sparrow Hawk's eggs from, and it was during one of my subsequent visits that I found my little pair of Hawks were repairing this old home of theirs from which I subsequently (28th April) took four eggs slightly incubated.



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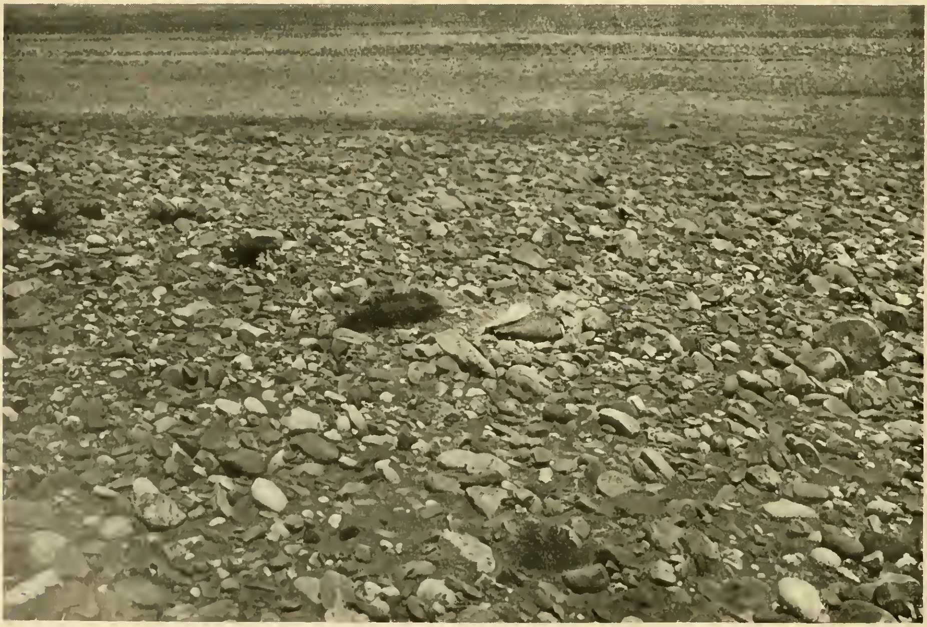

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THE IBIS-BILL (*Ibidorhynchus struthersi*).

A. Nest and Eggs.
B. Bird sitting on Nest.

The pluck of these little hawks in defence of their nest is wonderful, as, they swoop down on the marauder and once one struck my "topee", as I was watching the man at the nest, both male and female taking part in the attack; but they also have patience, as this pair returned to their first nest and hatched out their brood on the 14th June.

Three weeks to a month may therefore be taken as the length of time wild birds take to produce another sitting of eggs if the first sitting is taken and the following notes on the nesting of the Nightjar (*Caprimulgus andamanicus*) appear to substantiate this. Two fresh eggs laid on the ground as usual, taken on the 4th February 1907, and from a spot not a yard away, two more fresh eggs taken on the 25th February 1907.

Eggs from another pair were taken on the 6th March 1907, and again from a spot about two yards away, two more eggs slightly incubated on the 30th March 1907.

In 1908 I obtained two more clutches from the above first pair of birds on practically the same spot at an interval of about three weeks, but neither of these pair ever made an attempt at a third brood. I never visited the place this year, and I hope both pairs have raised their young in peace.

P. F. WICKHAM.

PORT BLAIR, ANDAMAN IS.
August 1909.

No. XIX.—NOTE ON INGLIS'S BUSH QUAIL (*MICROPERDIX INGLISI* GRANT).

To prevent any misunderstanding and to give honour where honour is due, I must state that the above bird was first obtained by my friend Mr. A. M. Primrose, unless the old skin in the British Museum is the same species. He sent me a pair of skins and then he and I together collected a series during a visit I paid him; an account of the shooting of the same was published in the Journal, at page 3 of this Volume.

CHAS. M. INGLIS.

BAGHOWNIE FACTORY, LAHERIA SERAI P.O.,
23rd August 1909.

No. XX.—NESTING OF THE IBIS BILL (*IBIDORHYNCHUS STRUTHERSI*).

(*With a Plate.*)

In 1906 I obtained one nest of this bird at Gyantse and a note regarding it appeared in the Journal. This year I found several nests but with one exception they were just hatching and I was unable to take the eggs. The accompanying photographs show the bird sitting on the nest and the nest with the four eggs. The nest is made of small smooth flat stones and is situated on the stony track at the side of the river. These photographs were taken at Gyantse (13,100 ft.) on the 21st May this year. I also obtained a nest in the Chumbi valley on the 13th May at an altitude of about 11,000 ft.

GYANTSE, TIBET, *June 1909*. F. M. BAILEY.

[The printers in reproducing the above photographs have lightened the background behind the bird sitting on the nest, thus making the bird more conspicuous. In the original negative it was only with the greatest difficulty that the bird could be discovered, so wonderfully did it and its nest amalgamate with its surroundings.—EDS.]

No. XXI.—THE SNIPE-BILLED GODWIT.

In "The Ibis" for July 1909 Mr. H. E. Dresser records the occurrence of the *Pseudoscolopax tacyanowskii* (*Macrorhamphus semipalmatus*, The Snipe-billed Godwit of the "Fauna of British India") in Western Siberia. Two birds, a male and female, were shot on 25th May 1908 "not far from Sara in the valley of the Irtysh, Tobolsk Government." The birds came into the hands of a correspondent of Mr. S. A. Buturlin, who skinned them and in the oviduct of the female found a fully coloured egg ready for laying. The bird was first described by Blyth in 1848 from a specimen obtained in the Calcutta Market.

No. XXII.—SECOND OCCURRENCE OF THE SNIPE-BILLED GODWIT IN ASSAM.

It is a good many years since I first recorded the occurrence of *Macrorhamphus semipalmatus* in Assam but, until a few days ago when a small flock of four were seen in Shillong, there has been no further record. This flock appears to have been seen by two or three sportsmen in Shillong and finally Major Wilson of the 8th Goorkhas, hearing about them, went in pursuit and coming across a pair shot one, fragments of which he was good enough to send on to me. These and Major Wilson's description sufficed to enable me to identify the bird as *Macrorhamphus semipalmatus*, the Snipe-billed Godwit. Within Indian limits this Godwit appears only as a rare straggler, as a rule in pairs or very small flocks but often singly. It may however be more or less frequently overlooked though its conspicuously long bill combined with its otherwise godwit like appearance would attract the attention of most sportsmen interested in Field Ornithology.

Very little is known about the habits of this rare wader and its nidification is also practically unknown though I possess a *reputed* pair of eggs taken by a Japanese collector in Manchuria. Major Wilson describes its note as very similar to that of the common Godwits.

E. C. STUART BAKER.

SHILLONG, 24*th October* 1909.

No. XXIII.—OCCURRENCE OF THE LESSER FLORICAN OR LIKH (*SYPHEOTIS AURITA*) OUT OF SEASON.

On reading Miscellaneous Note (XII) in Volume XIX, No. 1, of the Society's Journal, I have been led to record this note about the occurrence of florican, which, I did not at first think worth mentioning, as there is nothing very unusual in finding florican—stragglers of course—at other times than in the rains.

Last year I stopped at Wadhwan in Kathiavad on my way to Mahableshvar and on the 1st November Mr. Strip, the Principal of the Girasia School, Wadhwan, very kindly took me out black-buck shooting. I was stalking a Chinkara* which had sat down in a cotton field and could not be seen and was walking alongside a bullock-cart going in the usual narrowing circle, while my son Vijayarajji was walking through the next cotton field. Just as he got to the end of the field, to a patch of long green grass growing in a little depression in the ground, he put up three florican, a female and two young birds. We marked them down where they settled and then, with some beaters, walked very carefully several times over this ground, but the florican would not get up again. On returning to the spot where the birds had been flushed originally, I put up the female again and shot it but could not find the two smaller birds anywhere. We therefore gave up the search for them and went on after black-buck. After going about three miles we came across another florican, also a young bird, which I got, so that we saw on that day four florican and bagged two.

I shot also a female florican at Kas in the Satara district on the 21st November 1908 quite close to the Kas Bungalow overlooking the Lake.

When florican are met with out of season, they are generally taken to be females. This, I think, is due to the change in the plumage of the cock birds, which exactly resembles that of the hens, when the cocks have cast off their wedding costume, which they only put on in the breeding season.

BHUJ, 25*th September* 1909. R. K.

No. XXIV.—LATE BREEDING OF THE INDIAN LITTLE GREBE (*PODICIPES ALBIPENNIS*).

To-day I took a nest of the Indian Little Grebe which contained four perfectly fresh eggs. The female which was on the nest was in breeding plumage but other birds in the same piece of water had assumed the cold weather garb.

CHAS. M. INGLIS.

BAGHOWNIE FACTORY, LAHERIA SERAI P.O.,
23*rd October* 1909.

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* "Chinkárá" (चिन्कारा) is I believe a misnomer for "Chhinkárá" (छिन्कारा) as the little Gazelle is called in these parts, the latter name being derived from the sneeze like sound which it utters when alarmed; "chhink" (छिन्क) meaning a sneeze. It is also called "Kal punchhá Haran" or black-tailed deer and "Ratadiá Haran" or red deer on account of its fawn colour.

No. XXV.—INTELLIGENCE IN BIRDS.

In recording instances of "maternal solicitude" and the "injury feigning habit in birds" of various kinds I, for one, must confess that I never thought of ascribing the action of the birds, to anything but instinct and it never struck me, to watch more closely, to see if reason played any part, as Mr. Dewar appears to have done.

However, whether the injury feigning habit, is due to instinct or intelligence, I leave to men more capable of passing opinions on the subject than myself to solve the problem, but that in other matters, birds show a tolerable amount of intelligence, I do not think there can be much doubt, and a couple of instances, which have come under my personal notice, may be of interest.

The first case is that of a King Crow. I was waiting near the Wazirabad Railway Station, in the Punjab, for a very dark and large Peregrine Falcon, that I had noticed pass that way on three successive days, with my nets and nooses and hoping it would pass again that day, and while sitting on a stone, I watched a flock of mynahs, turning up leaves for worms, while on the telegraph wires above, sat a couple of King-Crows, a Roller and a Hoopoe. One of the mynahs, finally got a huge earth worm out, and the one next to it, promptly made for it to take away the tit-bit. Suddenly there was heard, close overhead the double note "titu" twice repeated of a "shikra" (*A. badius*). The mynahs and hoopoe, were off like a shot for the nearest tree, leaving the worm behind, when down came the King-Crow and secured the prize. I have frequently heard the King-Crow give this call and the imitation is simply perfect, but never before nor since, have I known one to make such use of his powers of mimicry.

The second instance is that of a Peregrine Falcon. I was after duck, in a narrow water channel with a caste of peregrines and we had been vainly trying to put up a gadwall. It had originally been flushed from a pond some distance away and taken refuge from the two peregrines, which were in hot pursuit, in this water cut, about 8 ft. wide, with sloping grassy banks. In vain we threw bricks and mud at it, but it would not leave the water, and if it did, it was only to fly ten yards or so, and drop in again the moment the falcons got near. Up and down that cut we went for about ten minutes, or more, till the duck took to diving, and as the little head appeared close to the edge, one of the falcons would make a dart for it, but only to find it gone, when she got there. Both falcons had given up "waiting on," and were now seated on the bank, close to the water's edge, but flew the moment the head appeared and made for it. The water was fairly clear and the duck quite visible when near the surface, and as it passed under one of the falcons, she ran along the edge beside it, not attempting to fly, and as the beak came up, in among a lot of grass, out shot a claw and grabbed it. I expected the duck to pull the falcon into the water, but she seemed to have provided for this contingency, and had a firm hold of the grass with her other foot. This feat struck me as having been well worked out, and she must have said to herself, after 10 minutes of vainly darting too and fro. " This is a poor sort of game, and each time I get near enough to make a grab, the beastly thing disappears under water and where I dare not go, and now here it comes, making straight for this grassy bit, where I have already had half a dozen shots at it, but it seems to see me in time to get out of the way, so let me see if I can do better by keeping to the ground and grabbing the head the moment it shows above the water, if near enough to the bank, as it generally is."

What appears to me to be a case of very deep reasoning on the part of a Golden Eagle (*A. chrysaëtus*) was brought to my notice only a short time ago.

I took a half fledged eyass from the nest in the middle of June last. On the 16th of July she had her first fly or rather a very poor attempt at one, but once having half flown, half tumbled out of the nest, I made for her, on a tree, she was always experimenting, and with the help of a strong breeze, got in some quite long flights, before the end of the month, till one day I lost all trace of her. Seeing no signs of her the next day, I went up the hill to some cliffs, some 2 to 3,000 feet above my bungalow, and was soon attracted by her call, and when I got round the spur, to my horror, I found her with two wild ones and presumably her parents, which flew off as I approached. Off she went with them and after vainly chasing them from ridge to ridge, I was on the point of giving up the job of getting her back as hopeless, but I had fortunately taken my gun with me to shoot her, a crow to call her with, *en route*, and as a last resort, thought I'd try peppering them, to get them away from her, for they always circled round where she sat. I got to within 50 yards or so of her and waited behind a rock, and as they passed overhead I gave them a charge each, and both went off very much faster than mine could follow, and as soon as they were gone, mine came down to me, without any trouble. Since then, my bird was once away for 6 days and came back of her own accord, closely pursued by the wild ones giving her a very poor time of it.

I keep her always loose, but now she hardly dares to leave the bungalow, and if she soars up to any height, she will suddenly be seen to drop, with closed wings and make straight for the bungalow, and two specks dropping from the heavens after her. On one occasion, one of them caught her up and gave her a very nasty whack and sent feathers flying in all directions

Only a fortnight ago, these very birds did their best to entice mine away, so why this sudden change in behaviour towards her now? Could they possibly connect the charge of shot, they each got into them, with her? This is the only explanation I can give, strange as it seems, and if this is the case, their reasoning is certainly very sound. The jesses and bells could not be the reason, as she had them on when she first went off with them.

Then again her returning to the bungalow, after being away for 6 days and when in trouble with her parents, to my mind shows a certain amount of reasoning power. Her natural impulse was to go off either with her parents or on her own and enjoy to the full her newly acquired powers of flight, and hunt for herself, but when she found she could not catch anything, and moreover got badly knocked about by her parents and was not so strong on the wing as she thought herself, she decided to return to the place where she had never gone to bed hungry, nor been ill-treated. Surely this shows a certain amount of intelligence. She knows my dogs and says nothing to them, but let a stranger dog appear and I have some difficulty in keeping her from going for it, and so long as the dog is in view, she does nothing but bait.

When first I taught her to come to the lure and gave her food on the ground, I had to be very cautious in all my dealings with her, and once she got her talons into her prey, I had to be very careful how I approached, for one foot invariably shot out and grabbed my gauntlet, while the other held on to the crow. She seemingly feared my taking it away from her and resented my even coming near. Now she permits me to handle her freely, even when feeding, and in the case of a bird, allows me to help her pluck the feathers and twist it and turn it about for her. It was instinct that first taught her to protect her property, and I took a photograph to show the way she covered up her food with her wings, and I hope to get another one taken as soon as possible to show the difference in her demeanour now when feeding. She must have reasoned it out and said to herself " There is no point about my hiding my food from this man, he does not try to take it from me, and moreover helps me to pluck the feathers, so I will let him handle my prey." Crows mobbing an eagle, generally take good care to keep well above him, but the moment the eagle happens to get above them, they very soon make tracks for the nearest scrub. Of course I allude to the hunting eagles, such as the Golden, the Bonellis or the various species of *Spizaeti* and not to the Imperial and Tawny and other carrion feeders which could not catch a crow under any circumstances. The crows know they are perfectly safe while above the eagle and moreover can rise as quick, if not quicker than he can. They would not dare to mob a peregrine falcon out in the open.

If any body wishes to try the experiment, go to a place near any river where crows are in the habit of roosting, and watch the place 3 or 4 days in succession. The moment an eagle comes along, and Bonellis eagles, frequently pay late visits to these corvine colonies, up will rise hundreds of them and mob him. A Peregrine comes along later and every crow will go helter skelter for all he is worth. Yet why ? Both are enemies and both have come there for the same purpose, *viz.*, to catch a crow for his dinner, so why not run from both, or attack both ? Is it instinct that has taught them, that one is much heavier and slower in rising than the other, and they can afford to play tricks with the one, which they would not dare with the other ?

An eagle that has come down to a bait without the slightest hesitation the first time, and been caught in a net and escaped, will never be so caught again in a hurry. This was the case with a Hodgson's Hawk Eagle (*S. nepalensis*) I caught in Kashmir. I knew him well by his wanting a crest and one wing feather The former was noticed while sitting and the latter when flying and he was always to be found in a deodar forest near my camp. The very first day I saw him, I caught him within 2 minutes of putting up my net and a pigeon behind it, but he escaped out of my hand shortly after. From that time on I tried him with nets and nooses, with fowls, doves, chikor and even an irresistible rat, but all to no purpose, and nothing would induce him to come again. One evening, however, I watched where he roosted for the night, and before it was light next morning I had gone and set my nooses, with a rat as the bait, and hid in a cave close at hand. As soon as it was sufficiently light to see, he came down without hesitation and was caught.

It was instinct that led to his capture in the first instance and in the last—a natural impulse, when hungry, to pounce on anything, more especially so, when that thing appeared in difficulties and unable to fly or get away ; but it looks very like reason that kept him from coming, the dozen or so other times, I tried for him. Sometimes he flew away as soon as I began putting up my nooses or net, even a couple of hundred yards away, and at other times, he simply sat on, but would not come down. When he saw me put up the net, he said to himself:— " Oh, there he is again at his old game, but I have been there once, and never again".

On the last occasion, he had not seen me and came down at once. Some birds show much more intelligence than others. I have known falcons to come down full speed and pull up dead at the net and go to one side, or over it, but would not go into it, whereas a pair of red-headed merlins (*Ae. chiquera)* on one occasion, actually seemed bent on being caught. The net had been put up a little too taut and would not give or fall, and first the tiercel came down, hit up against the net and fell back on to the ground ; then he made another attempt with the same result. In the meantime, the female came down and fared no better, but the net gave a little this time, and the sticks supporting it bent slightly. Then they both ran at it, to get to the quail on the other side, got their heads through the meshes and strained and pulled and fluttered, but would not give up, till finally the sticks fell and both were caught. A sparrow hawk (*Accipiter nisus*) I once caught in a net over a quail, got out of a hole in the net, just as I got up to him, but came down again 20 minutes later, for a sparrow, within 30 yards of where he had been caught before, into the same net, but did not get off that time.

The irresistible impulse of going for anything in difficulties, I should say was instinctive, but *not* to go for it, or pull up the moment the net is spotted as something suspicious and to be avoided, I can only put down to reason.

I do not wish to appear dogmatic, and only give these instances and my theories, for what they are worth

If I am wrong, I shall be only too glad to be put right, and am quite open to conviction, but so far I must admit that I still stick to my own opinion that birds and beasts show much more intelligence and reasoning power than we give them credit for.

C. H. DONALD, F.Z.S.

BUSHAHIR STATE, SIMLA DIST., 20*th September* 1909.

No. XXVI.—EXTENSION OF THE HABITAT OF THE SAND SNAKE (*ERYX JACULUS*).

Major O. A. Smith, among other snakes collected in Jhelum, has sent me a single small specimen of the Sand Snake (*Eryx jaculus*). This widely distributed species is reported by Boulenger (Cat. Vol. 1, p. 126) from the Ionian Islands and Greece in the West, Northern Africa, South West and Central Asia as far North as Turkestan, to the Western Afghan Boundary. Dr. Annandale has also recorded it from Seistan (Mem. As. Soc. Bengal, Vol. 1, No. 10, p. 200). As far as I am aware, it has never been reported farther east, so that its occurrence in the Indus Basin is a considerable extension of its previously known zone of distribution. It appears to me extremely likely that it has been encountered in the Indus Basin before, but taken for its common Indian relative *E. conicus*, but the sharp rostral transverse ridge, which is not seen in *conicus* is very distinct in this specimen. There are 9 quite smooth scales between the eyes, and the costals number at a point two heads-lengths behind the head 46, at midbody 52, and two heads-lengths before the vent 36. The ventrals are 189, and the subcaudals 30 of which the anterior 24 are entire. The anal shield is entire and narrower than the ventrals (about two-thirds).

F. WALL, C.M.Z.S., MAJOR, I.M.S.

CHITRAL, 15*th October* 1909.

No. XXVII.—A SECOND SPECIMEN OF THE SNAKE *OLIGODON ERYTHROGASTER* FROM THE EASTERN HIMALAYAS.

In 1907* Mr. Boulenger described this species from a single specimen obtained at Nagarkote, Nepal (6,000 feet) which is now preserved in the Indian Museum, Calcutta. I have just received another specimen from Tindharia which must have been collected at an altitude below 2,800 feet, and as no figure appeared with the original description, I herewith attach outline drawings to show the cephalic lepidosis.

I think there can be no doubt that this is the snake to which Dr. Günther † refers which Hodgson obtained in Nepal and made coloured drawings of, which he presented to the British Museum. Dr. Günther at first referred these to *S. octolineatus*, but subsequently expressed the opinion that they represented a species up to that time unknown.

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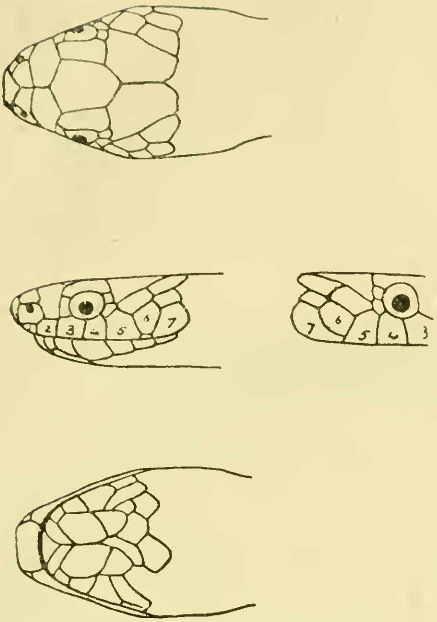
* Rec. Ind. Mus. Vol 1. pt. iii.

† Rept. Brit. Ind. 1864, p. 206.



Oligodon erythrogaster (× 2).

My specimen agrees well with the type which I have examined. The following features deserve special mention. The costals are 17 in the anterior and middle parts of the body, and decrease to 13 posteriorly. The absorption is effected thus—from 17 to 15 the 3rd and 4th rows above the ventrals on the right side, and the 4th and 5th on the left blend, and from 15 to 13 the 4th and 5th coalesce. (In this respect this specimen differs from the type, in which the rows reduce to 15.) The ventrals are 165, anal divided, and subcaudals in 57 pairs. There are 7 supralabials on both sides, and I think Mr. Boulenger would have been more correct if he had counted those shields as 7 in the type (not 6), for he records the temporals in the type as two, evidently taking the 6th supralabial for an inferior temporal. In my specimen the 6th supralabial fails to border the lip on the right side (as one sees sometimes in other species of *Oligodon* and *Simotes*) and has a small portion detached on the right side. The temporal, too, I consider single as I do in the type specimen.

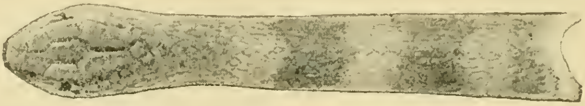
The dentition is peculiar. The *maxilla* supports 7 teeth on the left side, and 8 on the right of the usual syncranterian type seen in *Simotes* and *Oligodon*. There is a short edentulous space anteriorly. The palatine has 3 teeth on the left side and 2 on the right situated in the middle. The pterygoid has a single very small tooth near the middle. The mandible has a short edentulous space anteriorly, then 6 subequal teeth on the right side (5 on the left), then an edentulous interval followed by a single tooth.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

CHITRAL, 19*th November* 1909.

No. XXVIII.—A VARIETY OF THE COMMON COBRA (*NAIA TRIPUDIANS*) FROM CHITRAL.

On the 13th October a young cobra was brought in to me presenting characters of so distinctive a nature that I at first thought it claimed recognition as a variety distinct from any previously recorded. The first thing to attract attention is its colouration. Thus it is olive-brown completely banded with darker rings which are broader than the interspaces. The first band is below the neck, and this and the second are black, the third blackish brown, and the succeeding ones progressively lighter in colour, but remain apparent to the vent. On the belly, however, the hinder ones become less apparent, and are lost before the vent. There is no suspicion of any marks on the hood. I can find no differences in the lepidosis of this compared with variety *typica*, except in the scale rows. These, however, are very singular, numbering 19 at a point two heads-lengths behind the head, 19 at midbody, and 15 at a point two heads-lengths before the vent.* The ventrals number 195, and the subcaudals 69. I append a figure.



F. WALL, C.M.Z.S., MAJOR, I.M.S.

CHITRAL, 15*th October* 1909.

No. XXIX.—THE SNAKES OF KASHMIR.

During several visits to Kashmir I only came across four different kinds of snakes; two poisonous and two harmless. Of the latter, one was the ordinary *Dhâman* or Rat Snake (*Ptyas mucosus*). The natives I questioned in the matter, called it simply *sámp, i.e.,* "snake": it seemed to have no other local name. I saw no very large ones, and they struck me as being of a somewhat darker colour than those I had seen in India. They were fairly common in the main Valley. The other non poisonous snake I have not as yet been able to identify, but as I have a bottled specimen I hope to do so in a short time. I may merely state here that the snake is of slender make, about 18 inches in length and of a general ashy brown colour. I only found it in the Siddar Valley, above Páhlgám at an elevation of about 8,000′ to 9,000′. My natives could give it no local name.

The two venomous snakes were locally known as the *Pohur* and the *Gûnas* respectively.

The *Pohur* is the common Himalayan viper, *Ancistrodon himalayanus* described by Major Wall, I.M.S., on pages 34 and 35 of his book on the Poisonous Terrestrial Snakes of India, and mentioned by Lawrence on page 55 of his book "The Valley of Kashmir." Lawrence remarks that the bite of the *Pohur* like that of the *Gûnas* is said to be usually fatal. Colonel Unwin, whom Lawrence also quotes, believes the *Pohur* to be deadly but is doubtful about the *Gûnas*. Lawrence, on the other hand, states, that he lost one of his surveyors, who was bitten by a *Gûnas* at Sonâmarg. The descriptions given by both these writers, are somewhat vague and meagre and Colonel Unwin has, I think, got rather mixed up in applying the local names to his snakes. What he refers to as the *Pohur* is, I am confident, the larger of the two poisonous snakes, which is locally called the *Gûnas*. Lawrence does not make the same mistake, but passes over Colonel Unwin's without comment. Major Wall remarks in his book with regard to *Pohur*, that he knows of only one authentic record of a bite inflicted by this species. My own experience of it is as follows :—I found it at higher altitude than the *Gûnas* and far commoner. It simply swarmed in some localities ; for instance at Bakhtaor beyond Kauzilwán on the Gilgit road ; an open and rather swampy plain just above the village was an especially favourite locality for them ; also at Thaoba, the next village on the Kishengunga river ; again at Buj Marg in the Siddar Valley above Páhlgám, hardly a day passed without one or more being killed near my camp. I found them also in the Erin nala : in fact, I imagine they are to be found on the slopes in almost every part of the valley, only some localities are favoured by them more than others. The first case I came across of a man being bitten by a *Pohur* was in the Erin nala. It was late in the evening when a man arrived at my camp for medicine. The man who was bitten, he stated, was unable to walk. Having no permanganate of potash with me, I sent him some concentrated vinegar to rub into the wound. When I saw him the next morning I found he had been bitten in the foot ; his leg was much swollen with a ligature tied tight round it below the knees. The man was evidently in great pain, but said he was feeling better than he did when he sent to me on the previous night. He had not made use of the vinegar, but on the advice of a Goojar, he had applied a number of leeches all round the seat of the wound which had considerably relieved him. In a few days he had quite recovered. My next case was that of a Goojar, who managed to limp up to my camp, in the Siddar Valley. There were the usual symptoms, but there was less swelling than in the first case. The wound was in the foot, the man having been bitten in the foot while cutting grass. I treated him with permanganate of potash and he was all right again in a day or two. My worse case was that of a young fellow, who resided at Mundlan in the Siddar Valley. He was bitten in the ankle, and sent for me as soon as he reached home. I was with him in half an hour. His leg was much swollen, he had tied a ligature above the wound, and his mother was bathing his foot, with a native concoction of mud and some kind of herb. After washing the wound, I lanced it until the blood flowed freely and then applied the permanganate of potash. On the following morning, he was better and the next day about again. A few days after this, while out shikaring a Goojar was brought to me. He had been bitten some days before, on the point of the thumb·

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* This specimen proves to be an exceptional one, for since writing the above I have acquired 9 more, in all of which the scale rows are 21. Further in adult specimens all the bands are brown, and seem to grow less distinct with age. I have also examined two specimens of this variety in our Society's Collection, one from Aden, the other from Parachinar (N. W. Frontier). They constitute a variety of Boulenger's *Cœca*, and the young agree with a specimen figured by Eichwald (Faun Casp-Cauc. Plate XX) under the name *Tomyris axiana*.—F. W.

The usual swelling had disappeared but his thumb was quite black, the ball being filled to bursting, with decomposed blood. He had never thought of lancing it. I did this and the permanganate of potash did the rest. His thumb was saved, but it looked very like mortification when I first saw it.

I made many inquiries, but never heard of a fatal result from a bite. The permanganate of potash treatment certainly had good results. The natives soon recognized this, even my shikari, who started by laughing at it, but all the same, was one of the many applicants for a supply of it, when I was leaving Kashmir.

The so-called *Gûnas* or *Ghanus* of Kashmir is found at lower elevations as a rule than the *Pohur.* It is a larger snake than the latter, of an ashy grey colour, with 25 to 26 scales in the middle of the body. There is, in a specimen I shot, some indistinct light brown markings at the back of the head. The 13 or 14 central scales on the back are unmarked ; then comes a line of the same light brown colour, on either side, all down the back and the scales extending from these coloured lines to the ventral scales, some six in number on either side, are all more or less marked with the same colour. All my specimens were too much damaged for me to fix the identity of the snake with any degree of certainty. A damaged skin, I possess, measures 27 inches in length. The head is covered with small scales. As well as I can judge from Major Wall's description I think the snake must be *Vipera lebetina.* The natives declared that an old *Gunas* not *Pohur* as stated by Colonel Unwin, grew hairs on its head. I offered a large reward for a hairy specimen, but with no result ! The natives state that the bite of a *Gûnas* is generally fatal. I never came across a case, but have no reason for doubting their word.

L. L. FENTON, LT.-COL.

N. DEVON, 30*th September* 1909.

No. XXX.—DO WILD ANIMALS DIE A NATURAL DEATH.

I was much interested in finding that Col. Evans has, on page 273 of Vol. XIX of the Journal, taken up the question I started. But before writing any further I would like to point out that in my letter which he refers to I have not been dealt with quite fairly by the printer's devil. He has put in stops which I do not think were in my letter and in one place he has made me write "entirely Europeans, not the Natives of the jungles." What I wrote was "*not only Europeans, but the Natives of the jungles,*" which quite alters my letter as printed. My idea is that no wild animal ever gets the chance of dying from old age, but is always killed off and eaten by some other animal directly the powers that Nature has endowed him with become impaired. Possibly disease carries them off, but if so what becomes of them, for dead animals are seldom met with, and in the case of such as are found, death is ordinarily due to some violence that has been met with. I would have said in the absence of the instances given by Col. Evans, death is always traceable to violence of some sort or other ; for I have never come across any dead wild animals beyond the one mentioned in my first letter (and even that one may have been killed by a snake) that has not been killed by a tiger or met with a violent death of some sort or other. One does read of animals retiring to some secluded spot to die in, but what secluded spots are there that antelope (the animals that swarm in such numbers on the hot plains of India) can retire to ? My question " Has any one ever come across vultures feeding on a dead wild animal ?" of course, alludes to animals that have died a natural death.

W. G. BETHAM, I.F.S.

FRAMPTON-ON-SEVERN, GLOUCESTERSHIRE,
5th August, 1909.

No. XXXI.—ENTOMOLOGICAL NOTES.

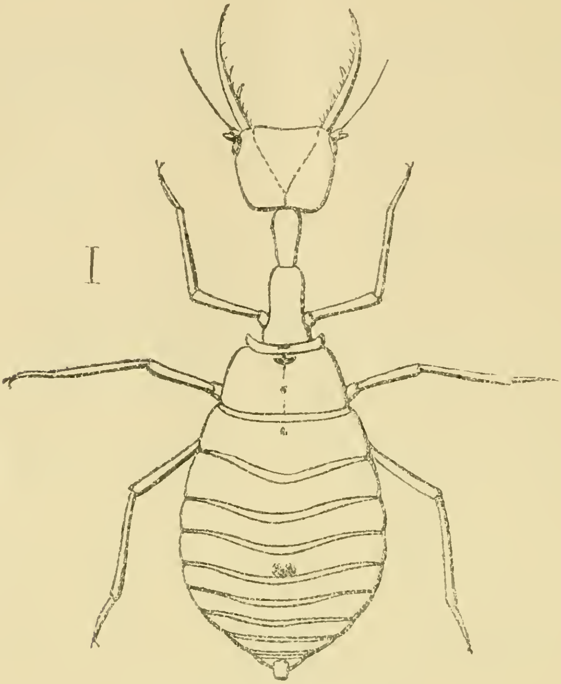
(*a*)—THE INTERNATIONAL CONGRESS.

An International Congress of Entomology is to be held in 1910 at Brussels, a little time before the International Congress of Zoology to be held at Graz. This Congress will be the first for Entomology as a separate subject, and resolutions made by the Congress will then be put before the Zoological Congress.

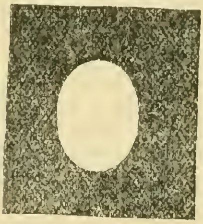
An Indian Sub-committee has been formed of which the Honorary Secretary of this Society is a member ; printed information will be sent out to all who are interested ; the Sub-committee are especially anxious to find a delegate to represent India at the Congress, and hope to hear of some member of the Society who is keen on Entomology and who will be in Europe at that time and willing to attend the Congress, which meets from August 1st to 6th. The Sub-committee also wishes to obtain papers to be read at the Congress and will be very glad to hear from members who will submit papers on any branch of Entomology. The Congress is meant to discusss all aspects of entomology, the applied as well as the technical, and it is hoped that such important questions as insects and disease, insects in relation to man and agriculture will be a feature of the Congress. Papers may be sent to the Honorary Secretary, or to the Chairman of the Indian Sub-committee, the Imperial Entomologist at Pusa.

(*b*)—THE INDIAN NEMOPTERID AND ITS FOOD.

In " Indian Insect Life" (p. 160) some notes were given upon the egg and larva of the common hemopterid (*Croce filipennis Westd*) ; since that time, these larvæ have continued to flourish in captivity, and it has been found that their food is the egg and immature stages of the common fish insect (*Acrotelsa collaris*, Fabr.) which is so abundant in houses ; to feed the former, the fish insect is being bred also. The larva of *Croce* has not as yet developed the long neck, characteristic of the larva figured in text-books ; its development is slow, and it is apparently one-brooded, a whole year being occupied by its metamorphosis. The larva is small, soft and whitish in colour ; it is probably extremely common in houses, but lives a retired life, being active at night.



Croce filipennis larva, first stage.



Acrotalsa egg (× 15).

The fish insect is fed wholly upon paper, and thrives on that diet ; its eggs are soft, oval white eggs, laid, in captivity, among the paper loosely and not adhering to each other on the paper. The nymphs are readily reared on paper, and the whole life history goes on in an ordinary bottle containing torn-up paper.

In the Pusa Laboratory, which has been occupied only one year, there has been a plague of fish insects which have multiplied enormously, feeding on all abels, papers, etc., which are not poisoned or shut up. This is likely to be due to the fact that, as yet, *Croce filipennis* has not found the building to be a suitable habitat, and the fish insect is breeding unchecked when, in an old building, its enemy would also be in occupation. This may apply also to other enemies of the fish insect if there are any ; the fish insect was brought into the Laboratory with records, etc., and is extremely abundant now.

(*c*.)—STORAGE OF INSECTS.

In a previous issue of this Journal, some information was given about storage of pinned insects. Another year's experience has shown that the paraffin-napthalin box described there has been almost entirely successful : in three boxes, out of over 150, mould appeared on a few specimens ; no insects were found attacking the specimens at all.

A modification of the box, in which an enamelled cork sheet, set in paraffin, was put in the bottom of the box, and the paraffin-naphthalene mixture above, has proved a failure, and the box, as originally made, is apparently the best. No benzene or other chemical at all is applied to these boxes, and, in spite of a very wet season, the collections have been better preserved than in any previous year.

(*d*.)—ALCIDES.

The genus *Alcides*, among the weevils, is known to contain several species injurious to crops, and a new one has recently been added ; *A collaris*, Pasc. has been reared from swellings found upon the stems of tur plants (*Cajanus indicus*) ; these swellings are like galls, found upon the stem at soil level on young plants at Dharwar farm. The grub is in the gall and pupates there, the weevil emerging by biting through the gall. The insect is in no way a serious pest, as it is not a common or abundant insect ; so little is known of weevil's life-histories that this record is of interest ; the other two common species of *Alcides* in India breed in cotton (*Alcides leopardus Ol*) ; and in species of Sesbania used as shade for the growth of *pan* (*Alcides bubo*, F.), both being destructive pests where they occur.

(*e*).—THE DECCAN GRASSHOPPER.

Amongst the interesting occurrences of the year is the study of the curious wingless Grasshopper of the Deccan, which has been doing an increasing amount of damage, culminating in a fairly large outbreak this year. The insect is a species of *Orthacris* of the *Pyrgomorphine* division of the *Acridiidæ* ; five Indian species are described and the present species is probably a new one.

It is, when mature, wingless, and resembles an ordinary hopper ; it is likely to be one of the insects which, by coupling in a wingless and therefore *apparently* immature condition, has given rise to the statement that there are species in India which couple before completing the matamorphosis and passing through the last moult. The other species associated with this belief is the Rice Grasshopper (*Hieroglyphus banian*, Fabr.) which has short-winged mature forms, which look like nymphs but are really mature ; these of course couple and lay eggs while appearing to be nymphs.

(*f.*)—NEW RHYNCHOTA.

Large numbers of new *Rhynchota* are still being described by Mr. Distant, the last series being in the Annales de la Societe' de Belgique, where thirty species are added to the Indian fauna. The most interesting are the three species of *Salda* and two of *Aradus* ; these obscure families are little collected or known in India, and there are probably many species to be found in the moist hill tracts of India. *Salda pusana* Dist, described from specimens that were mutilated by the Post Office in transit to England, was found at Lebong on the boulders in the river over which the water pours producing a thick growth on the sheltered underside of green moss, in which lives a very peculiar fauna. The collector in the hills will find extremely interesting material in such localities. The appendix volume of the Rhynchota in which all the new species will be described, will be awaited with interest, and it is to be hoped that all who have collections of *Rhynchota* will have them examined, and the new species sent to Mr. Distant for inclusion in this volume.

(*g*).—WHERE CICINDELA BREEDS.

Cicindelid beetles are common insects of the plains, occurring abundantly in crops, waste-lands, and especially on flooded lands at the close of the rains. While larvæ which corresponded with *Cicindela* larvæ, in Europe have been found in wet sand near rivers, they have been so rarely found that they could not represent the common species which occur in abundance. Recently such larvæ have been found in greater abundance and under circumstances that point to their being the common species so abundant in the plains. The larvæ were found in land which had been slightly waterlogged and so was well compacted and solid after the rains closed; each larva lives in a vertical tunnel, as is well-known, the tunnel ending at the surface in a round hole ; when one looks at the soil in which such larvæ are living, one sees a small hole ; watching it and then looking away at others, the original hole disappears and cannot be seen ; *Cicindela* larva has come up, and its flat dark head has filled up the top level with the soil ; if one moves, down goes the *Cicindela*, and the hole is at once obvious. Such holes are common in wet lands in October, and the tunnels extend down about five inches into the soil ; the *Cicindela* larva grips anything that runs over by its recurved mandibles, which project over the head ; it then goes down with the victim, feeds on it, and placing the empty skin on the flat head ascends to the surface and jerks the remains away clear of the opening of the tunnel.

In September, the common species of *Cicindela* are extremely abundant as beetles on wet alluvial lands near rivers, on the wetter parts of cultivated lands where the soil is compact and are presumably laying the eggs from which come the larvæ to be found in late October, before which time the beetles are dead.

Cicindela has not, in this country, been reared as yet; all our previous attempts have been failures, but with a larger supply of material, we hope to be more successful.

(*h*).—ATTRACTION TO LIGHT.

In "Indian Insect Life" (p. 106) we have discussed this point, and those who have read the interlude there may be interested in the subject. Forel, the author of "The Senses of Insects," has there pointed out that the attraction of a bright light is probably due to the confusion produced in the brain of the insect by a concentrated point of light, an effect occurring in Nature only from the sun which is overheard, while our lights are at the insect's level. He also rightly points out that household insects are not attracted by light, being accustomed to our artificial lights and not attracted by them. On the other hand, moths especially are freely attracted by a large white sheet, that is, an area of diffused white light, in preference to a point of light.

A long series of experiments were made in India with coloured lights, but they yielded little result of interest.

Another point is that the bulk of the insects which come to light are crepuscular soil insects, accustomed to fly in the dark and entirely unaccustomed to a concentrated bright light.

We have found also that in bad weather, many insects come to light that do not ordinarily do so, and we believe this is not so much the light as shelter from the wind. Bees and dragon flies are quite common at lights in houses in rough weather, whereas they are never so found ordinarily ; the bees have presumably been overtaken before they could reach the rest, and the dragon flies, ordinarily sleeping out in an exposed position, are the first to feel a high wind and be blown away.

Light traps are in fairly common use as against some pests, especially in the tropics, but the opinion is often expressed that a light trap catches more beneficial than injurious insects, and so does harm. We believe this to be an entirely mistaken idea ; the 'parasites' that the light is supposed to attract are usually winged ants.

(*i*).—THE EGGS OF OLIGOTOMA.

Embiidæ are insects, of which not much is known, though they are to be found in most localities in India. In the plains all attempts to rear them have failed, but under more favourable circumstances at Lebong, at an elevation 5,000 feet, *Oligotoma saundersi* lived for weeks in captivity laying eggs freely. The eggs are oval, pearly-white, laid singly or a few together on the tree or the bark under which they live, in or near the silvery ramifying tubes prepared by the insects. The young are white and become pink as they grow older. We found colonies of these insects in all stages under the bark of a dead tree ; in captivity they lived quite well, feeding apparently upon the bark ; there was no other food and the colony throve and multiplied, laying eggs freely.

In the plains the colony died, despite all precautions, probably from the altered conditions of moisture.

H. MAXWELL LEFROY

AGRICULTURAL RESEARCH INSTITUTE,
PUSA, BENGAL, *December*, 1909.

No. XXXII.—SOME NOTES ON THE PALM *OREODOXA REGIA.*

(*With a Plate.*)

Oreodoxa regia, though a native of Cuba, is very commonly found cultivated in Indian gardens. As might well be expected, it is treated of by many botanists, but strange to say their descriptions sometimes widely differ from one another, as will be seen from the following short account :—

Bentham and Hooker[1] say that there are two complete spathes, the lower one semi-cylindrical as long as the spadix, the upper one ensiform, split on the ventral side. Kunth[2] mentions that there is only one spathe. Scheffer[3] is also of the same opinion. In a specimen which I examined there are clearly two spathes. The whole inflorescence, a compound spadix, is enclosed in a big complete spathe measuring 3′-1″ (fig. I-*a*). A second incomplete spathe entirely surrounds the lower half of the complete spathe. The incomplete spathe is 1′-2″ long on the ventral side and 9″ on the dorsal (fig. I-*b*). The outer one is incomplete in a later stage, but may have been complete in the beginning and due to the faster growth of the inner spathe, left incomplete. In the beginning of January when I observed the spathes, the inner one was about 1′ long and the outer about 3″. At the end of June they attained their full development. The incomplete spathe detaches itself from the inflorescence, leaving a scar (fig I.-*c*), sometime before the complete spathe opens. The complete spathe opens ventrally by a slit (fig. I-*d*).

Kunth says that the flower bearing branches of the spadix measure from 3″ to 4″. In my specimen they were from 2″ to 6″ long. The girth of the main peduncle is 6″. The primary as well as the secondary peduncles are scurvy. The length of the inflorescence is 2′-3″.

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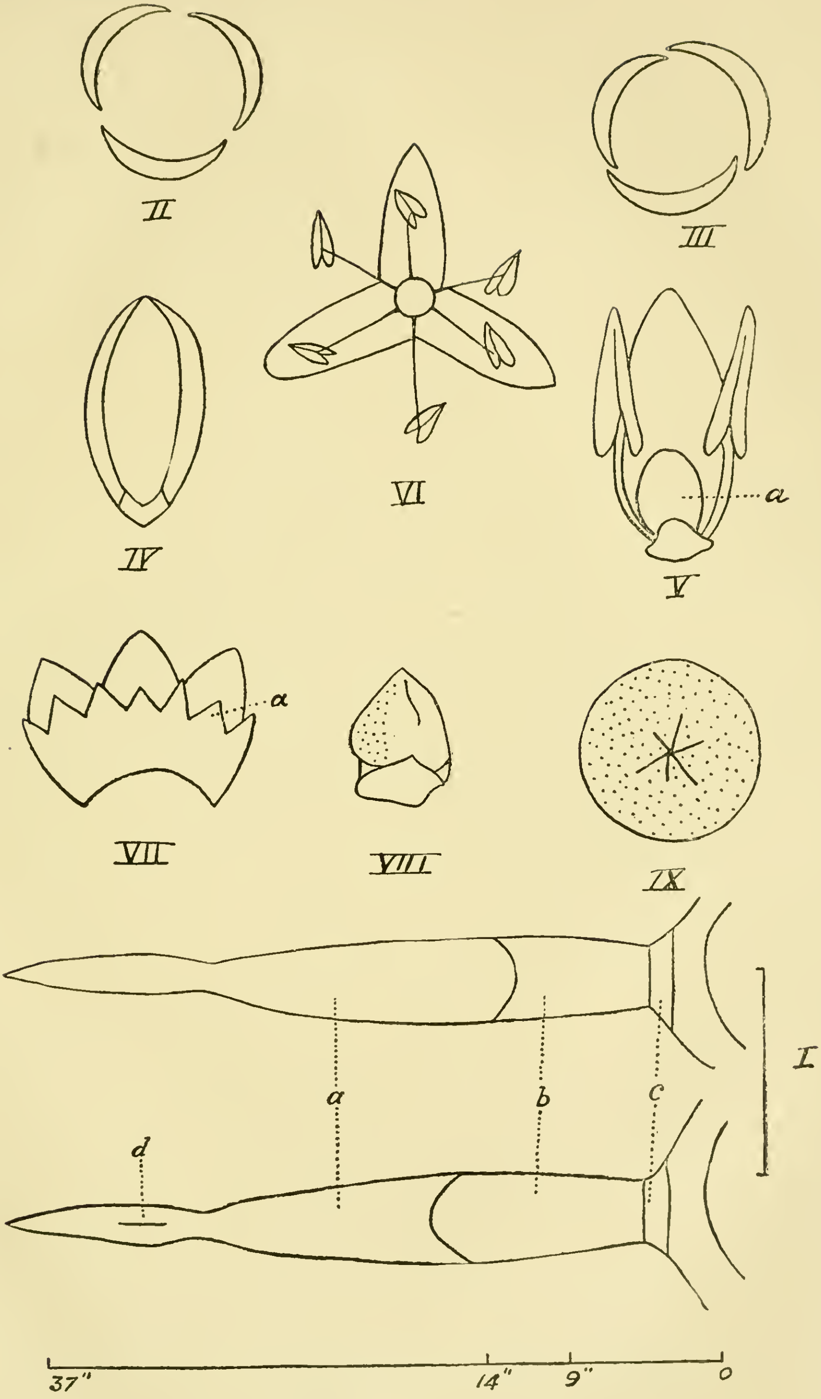
[1] Genera plantarum, Vol. III. p. 898-900.

[2] Kunth in Humb. et Bompl. nova Gen. et. Spec. pl. Vol. I, p. 244.

[3] Scheffer in a manuscript note according to Beccari in "Illustrazione dialcune Palme Viventi nel Giardino Botanico di Buitenzorg in Annales du jardin Botanique de Buitenzorg, Vol. II, p. 148."


II
III
VI
IV
V
a
VII
a
VIII
IX
a
b
c
d
I
37″
14″
9″
0

OREODOXA REGIA.

The flowers are unisexual. The male flowers are in pairs, while the female flowers are solitary. Each female flower is situated between and below every pair of male flowers.

The sepals are three, white, membranous, sub-orbicular and obtuse. The æstivation is imbricate (fig. III.) The sepals of female flowers are longer than those of the male (figs. IV, VIII).

Beccari[1] mentions that it is not seldom to find a second whorl of petals, in male flowers, alternating with the outer whorl of petals. I examined many flowers, but did not notice the presence of this second whorl. The petals are three, white, linear, oblong, obtuse, concave and longitudinally striated. The æstivation is valvate (fig. II.) The petals of the male flowers are longer than those of the female (figs. IV, VIII).

The male flowers when closed are longer than broad (fig. IV). The anthers are pinkish, sagittate and versatile (fig. VI). The stamens are 6-9, nine predominating. The filaments are flattened at the base. A subglobose pistilode, as big as a poppy seed, is situated in the centre of the flower, surrounded by the whorl of stamens (fig.V-*a*). The pistilode is trilocular. The pollen grains are more or less oval.

Bentham and Hooker[2] mention that the ovary is bilocular. I examined many flowers and found the ovary to be trilocular. In some, false dissepiments were also observed (fig. IX). There are six staminodes surrounding the ovary and so to say forming a cupule (fig. VII-*a*). I did not notice any more details in the female flowers, as they had not opened when I examined them.

J. P. MULLAN, M. A.

BOMBAY, 30*th July*, 1909.

No. XXXIII.—ENVIRONMENT *VERSUS* NATURAL SELECTION AS THE CAUSE OF COLOURATION IN ANIMALS.

In the course of his very interesting paper "Some Nature Notes," which appeared on pp. 399 *et seq.* of Vol. XIX, No. 2, of the Journal, Col. Burton contributed some remarks bearing on the subject of protective colouration.

The author of that paper looks with suspicion upon the view generally held by naturalists and considers them "rather far fetched". He quotes Mr. Selous, the South African authority, in support of the theory he opposes to that of protective colouration, *viz., the effect of environment.*

This is a matter of great interest which, I believe, has not hitherto been discussed in our Journal, and I hope, therefore, that I may be allowed to trespass in a small measure on its pages.

The views of practical observers like Col. Burton and Mr. Selous are deserving of the highest consideration and they are fully entitled to an opinion, but,

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[1] Beccari l. c.

[2] Bentham and Hooker l. c.

I venture to suggest that those who agree with them in this matter do so under a partial misconception of the foundations upon which the theory of protective colouration is built. That there is such a misconception I hold to be proved by the presence of the following sentences culled from the two authors.

Col. Burton, in the above quoted contribution, on page 401, writes "I am inclined to think that colouration is far more due to environment, to the colour of the surroundings and to climatic causes, than to *sexual selection* for protective purposes."

Mr. Selous, in his "African Nature Notes and Reminiscences" says, on page 5, line 1, " . . . . The colour of the leucoryx . . . . . has not been brought about *in order* to serve as a protection against enemies." (In both cases the italics are mine.)

I think the misconception in either case is patent, though perhaps the word *sexual* in the first quotation is a clerical error and should read *natural*. It appears to me that both authors have misunderstood the theory of protective colouration by adaptation through natural selection.

It is perhaps possible to agree that some naturalists have claimed to explain too much by the light of this hypothesis, but, reading carefully through Mr. Selous two chapters on protective colouration, the impression created is that he rejects protective colouration altogether, though not positively stating the fact.

Now it is quite possible that environment has some influence on the colouration of animals (though that has to be proved as well as the exact agency through which it acts); but this in no way affects the theory of protective colouration, rather the contrary.

Every one will admit that if it is environment that influences colouration, it must do so in a great variety of shades to account for the great differences in the colour of animals inhabiting the same locality, *e. g.*, tiger, sambar, sloth bear, bison, etc., in India; and the divergence is still more striking in South Africa with the lion, the zebra, the buffalo and the various splendidly coloured antelopes living in the same plains.

This being so, then either all animals, under this influence, should eventually assume the same coats, or else external specific features must tend to disappear as there is nothing to fix the colour, which may, at any time, be gradually changed to any of the other colours brought about by the particular environment.

We here come to the "clou:" *there must be some force or influence to fix a particular colour and we have that agency in natural selection.*

Nothing is more certain than the fact that constant slight variations in dimensions as well as in colour do crop up among animals of the same species. Probably no two individuals are exactly alike in every respect. No one will quarrel, I think, with the assertion that no variation, however slight, can fail to reach in some way on the organism in which it appears. In the vast majority of cases, however, this reaction is so infinitesimal that it may be entirely neglected. But a point must come when it is no longer negligible, and now its influence must inevitably be either harmful or beneficial to the animal. Here natural selection steps in. If the variation is definitely harmful it cannot endure, if, on the contrary, it is beneficial it will be handed down and become permanent. I leave out of count such variations that may arise by correlation. These in no sense affect the argument, for it then becomes merely a question of which of the correlated variations exercises the more potent influence.

The mere fact that animals are usually coloured in harmony with their surroundings is no disproof of protective colouration as our authors would infer, for, obviously, to be protected by its colour the animal *must be in harmony with its environment*, subject to certain exceptions that will be dealt with anon.

No one, as far as I know, claims that an animal attains a certain colour or marking *in order* that its colouration should serve as a protection. But rather because it has tended towards a similarity with its environment, natural selection preserves and intensifies the similarity.

There can be little doubt that variations occur in a direction away from the general colour scheme of the environment but it is exactly those variations that natural selection tends to suppress, unless they subserve some other and more important purpose, or the same purpose in another way.

So it may be seen that it is precisely where the hypothesis of protective colouration might fail that that of colouration by the influence of the environment would also fall short.

It is, however, quite possible that environment (in conjunction with other causes) gives the first impetus towards protective colouration and this is then seized upon and worked up by natural selection, which in itself, of course, is incapable of initiating a variation.

Unless it can be proved that it is of advantage in resisting climatic rigours, there is no intrinsic value to an organism in being coloured in harmony with its environment. But where such colour is protective against its enemies or facilitates the obtaining of its food, the benefit is distinct and it will be perpetuated.

One of the points both authors wish to make in disproof of protective colouration, is that it can only be effective when animals are motionless, and that they betray themselves as soon as they stir, even if it be only a switch of the tail. This is obvious and it cannot be contended that protective colouration conceals the animal at all times and under all conditions. In the nature of things this is out of the question for any being less well endowed than the chameleon, and even that reptile requires a little time. But an attentive perusal of Mr. Selous' book will show that protectively coloured animals do benefit by their colouration. It must also be within the experience of every big game hunter to have intently gazed upon an animal whose coat blended with the back ground without seeing it until it has suddenly dashed off, giving no chance of a shot.

Animals that are protectively coloured are in the habit of remaining motionless when alarmed. thus unconsciously giving full play to their special safe guard.

Again reading Mr. Selous' account of the manner in which lions stalk their prey must convince one that these carnivora owe a great debt to the colour of their skin and, what is more, that they understand how to take full advantage of the fact.

To contend that colouration gives complete protection under all conditions involves one in the following *reductio ad absurdum.* The natural corollary to the contention is that carnivorous animals would never secure any prey, except by mere chance, and therefore, would rapidly disappear through starvation, while at the same time, no herbivorous animal would ever escape from a protectively coloured beast of prey and they too would all succumb.

It is to be presumed that the opponents of natural selection (for that is what it amounts to) admit that colouration and markings in animals are the result of a process of evolution and that the instinct to remain perfectly still under danger is likewise brought about of evolution. Then, believing as they do in the environment theory, they must hold that the two characteristics were evolved separately and unconnectedly and yet eventually were united, for they are shared in the same, or almost the same-degree by every individual of the same species.

This is surely too much to concede. The two traits must have been evolved together and the one as a complement to the other, as each apart would be more or less useless, if not often harmful.

The theory of colouring induced by environment seems to me necessarily to exclude variation in colouration. Once a species is coloured in harmony with its surroundings and *as a result of them*, they would not be able to vary much thereafter, as the same influence, it must be presumed, would tend to bring them back to the type.

But there is nothing more certain than the fact that variations constantly do occur, which variations if harmful will again disappear and if beneficial will endure and become fixed into new types. If the new type has a distinct advantage over the parent the latter will tend to disappear, otherwise the variation becomes a well defined race or variety, and in course of time draws further and more definitely apart and evolves into a new species—possibly eventually into a new genus.

With colouration by environment new species could only arise when some of the individuals of a species migrated to new regions, the environments of which would differ to a certain extent from that they have left. But, as a matter of fact, we know that new species arise in the same localities, the original type often enduring side by side with the new.

It must not be forgotten that, as a rule, the evolutionary process is slow and spread over a period of very many years.

Mr. Selous states that zebras, impala antelopes, giraffes, etc., are very striking objects in their natural surroundings and that, therefore, there can be no question of protective colouration in their case. There seems to be a diversity of opinion on this subject, as shown by Colonel Burton in his quotation from Sir Samuel Baker (page 403). However, even admitting that Mr. Selous is right, it cripples his theory of colouration by environment at least as much.

This brings me to the weakest point of the environment theory—it fails to give a satisfactory cause for mimicry. Mr. Selous attempts to prop his case by one reference to those phenomena, but, in my humble opinion, fails entirely to achieve his object.

He describes a South African butterfly—*Precis artaxia*—which below is coloured in the exact resemblance of a dead leaf, but is bright hued above (apparently a very similar insect to the Indian genus *Kallima*). He explains the markings of the undersurface of the wings by the influence of the dead leaves of the forest floor among which this butterfly settles. This indeed must strike one as far fetched. One might admit that, through some at present still mysterious agency, the environment of dead leaves could influence the butterfly to assume a universal sombre hue, or even a blotched appearance vaguely resembling the colour and shape of a dead leaf, but that it can call into being markings closely copying the venation of a leaf and add a short tail to the hind wing to represent the leaf stalk, is more than the imagination will rise to.

Then, too, how is one to account for the bright colours of the dorsal aspect of the insect ? Is one to understand that the action of the environment is more or less of a photographic nature and does not act on the upper surface because the wings are usually held applied together, or because they are turned away from the dead leaves ? Accepting the influence of environment it seems more reasonable to believe that the effect is through a reaction of the whole vital organism and not merely on surfaces exposed.

Mr. Selous goes on to state that there seems no reason why butterflies in South Africa should be protectively coloured as he has never seen a bird attempt to catch a butterfly, but these insects have other enemies, lizards for instance.

There are numberless examples of more or less perfect mimicry, some so minutely accurate in every detail as to be absolutely inexplicable except by adaptation for protective purposes working through natural selection.

And this adaptation must be not merely on the one side but interacting on both—the prey and the preyer. The one becoming more and more perfect for concealment while the other becomes more and more qualified to detect the fraud.

At least no more plausible, no more convincing hypothesis, indeed no other credible explanation, has as yet been suggested to my knowledge.

It was Bates, I think, who described an incident of which he was an eye witness in South America. I write from memory and may be incorrect in detail, but the main facts are accurate.

Bates observed a species of mantis that closely imitated a leaf which found itself in the track of an army of the terrible foraging ants of those regions. Seeming aware of its dangerous situation it remained perfectly inert, while the ants crawled over it and left it unmolested. Had it moved in the slightest it would inevitably have been torn to pieces.

Again we have butterflies that obtain comparative immunity through their close resemblance to other lepidoptera which are distasteful to animals that prey on this class of insects. Others again mimic bees and wasps. Certain spiders and mantids in this country are fashioned so as to be indistinguishable from ants without the very closest scrutiny. Other spiders escape detection through their similarity to the particles of debris that conglomerate in their webs and among which they squat motionless. Yet another Indian spider—*Peucetia viridana*—is strikingly like the fruit of a small shrub—*Jatropha gossypifolia*. It undoubtedly secures much of its living booty by squatting among flowers and pouncing on unwary insect visitors in search of honey, they mistaking the spider for the fruit. This spider does not restrict itself to the shrub referred to and may be found on other shrubs, therefore its colour and marking cannot be due to environment. Besides why should it not resemble the flowers of *Jatropha*, the latter are more striking, being red, the berry being light-green traversed by a few whitish lines—all of which as well as the long hairs on the stalk are admirably reproduced on the spider's abdomen and legs.

Let us now consider the bright and very showy colours of certain caterpillars and Orthoptera, or of the large spider common in many Indian jungles, a very conspicuous object suspended in the middle of a large yellow viscous web stretched across paths or clearings—*Nephila maculata*. These colours cannot be accounted for as induced by environment. They are, however, explained by natural selection, for they are *warning colours*. The creatures thus coloured are distasteful to the enemies of allied animals for one reason or another, and it is to their advantage to blazon abroad, that all that fly may know, the fact that they are unsavoury—perchance poisonous.

That this is not mere speculation is proved by many recorded observations. In the pages of our Journal some years ago (I have not access to my books at present) a note was published on the subject of a bear in captivity, that held brilliantly adorned locusts in abhorence, though inordinately fond of others of more sober (protectively coloured) dress.

Numerous other facts of a like nature might be quoted, but I need only refer the reader to the pages of Darwin and Wallace and I will content myself with one more and that perhaps the most striking of any, in support of my thesis.

I ask how else than by the theory of protective colouration fostered by natural selection is the extraordinarily faithful imitation by certain moths of the excreta of birds to be explained. These moths usually lie on green leaves just in the position chance-fallen excreta would take up. It requires a close inspection to recognise the one from the other, as any one who saw this year's Darwin exhibit at the Natural History Museum at South Kensington will testify to. And the resemblance in living specimens is still more deceptive.

Here, surely, no sketch of imagination can bring environmental colouration into play—that would require the moths to be green.

To me the recital of the above arguments seem to prove conclusively that whatever the effect of environment on the colouration of animals it cannot explain all the known facts, whereas protective colouration (including warning colours) through the agency of natural selection, does.

While on the subject of Colonel Burton's article perhaps I may be permitted to add a note to his remarks anent wanton slaughter by tigers.

Some years ago in Ganjam a tigress, accompanied by two cubs still too young to do their own killing, butchered four cows at different points several furlongs apart in the same night. Only one was partly eaten and a native shikari shot the tigress at this kill while I was preparing to sit over one of the others, not having heard till too late that there were more than one. The explanation in this case may be that the mother was instructing her cubs in the art of cattle killing.

C. E. C. FISCHER.

COIMBATORE, *4th December* 1909.

No. XXXIV.—ON THE OCCURRENCE OF THE BUTTERFLY *ATELLA ALCIPPE*, CRAMER, IN TRAVANCORE.

Through the courtesy of the Director of the Government Museum, Trivandrum, I have had sent me a specimen of the above butterfly, which was captured by Mr. Hockin at Kalasagarem in June 1906. This is the first occurrence of this insect in Travancore, and I was not aware, until the last number of the Journal appeared (No. 3, Vol. XIX), that it occurred in S. India at all but Mr. Bell states that it is very local in Kanara.

We can now understand how the butterfly reached Ceylon, which before was inexplicable. When I described the Ceylon form under the name *A. alcippe* race *ceylonica* (Vol. XIV. p. 716), the nearest habitat then known was Sikhim and the Andaman Islands. The specimen from Travancore conforms to the type, and is markedly different from the Ceylon race, which is distinguished by the uniformly black apex to the forewing. The late Mr de Nicéville gave a useful list of the known species of the group in his paper entitled "On new and little known butterflies, mostly from the Oriental region," Vol. XIV. p. 243.

N. MANDERS, LIEUT.-COL., F.Z.S., F.E.S.

COLOMBO, *December* 1909.

EXTRACTS FROM THE PROCEEDINGS OF THE MEETINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY HELD IN THE QUETTA MUSEUM AND LIBRARY BUILDING ON 29TH JULY, 26TH AUGUST, 30TH SEPTEMBER AND 28TH OCTOBER 1909.

29th July 1909.

Read letter dated the 28th July 1909, from Major F. C. Webb-Ware, C.I.E., and an extract from letter of the same date from Mr. G. H. Frost, regarding the Quetta Cicada. The Honorary Secretary remarked that on the 3rd July he found a pupa crawling on the ground and that the flying insect emerged in an hour's time. He also remarked that all the flying insects in the station had disappeared by about the 10th of the month.

Dated 20th July 1909.

DEAR MR. CUMMING,

Your interesting note on the subject of the Cicada which recently appeared in such numbers in Quetta. I have been connected with Quetta now for nearly 20 years, but I certainly do not recollect the swarms or in fact any but isolated insects of this species. There is a small type of this same insect which is common to Baluchistan, and is usually to be found where fairly long grass grows. For instance, I have frequently seen it at Pishin. The pupa in, I think, the larger number of cases emerges in its pupa covering from the ground and climbs on to a branch of the nearest tree. You will always find their holes below trees or bushes. The pupa then suns itself for a short period and emerges from its covering which splits open down the back. After sunning itself for some little time, the fully developed insect dries and then can take to flight. The noise they make is due to the rapid vibration of a membrane which is situated on either side of where the body and extremity join. They emit three or four notes, and I dare say you noticed that the Cicada on one tree always emit the same note. The most interesting fact to ascertain is why it is that these insects should have appeared in such numbers this year, also their method of propagating their species, etc. In Australia you obtain various kinds of the same, but they run to 1½ to 2 inches long, and have the most brilliant colouring, gold being common. In Seistan the Cicada—a small black type—used to give us considerable trouble by appearing uninvited at dinner.—Yours sincerely.

F. C. WEBB-WARE.

DEAR SIR,

I notice the black ants are carrying the eggs of the Cicada away and should therefore be the means of great reduction in the number that comes to the larval stage.

(Sd.) G. H. FROST.

Read letter, dated the 16th July 1909, from Captain A. D. G. Ramsay to the Hon'ble the Agent to the Governor-General, suggesting that Bee-keeping be tried as an experiment in Baluchistan: also a note by the Honorary Secretary to the effect that, although no honey bees had so far been found in Quetta, he did not see why they should not thrive if imported. He added that honey was procurable in parts of Chagai District. Mr. Porter remarked that honey was also to be found in Hindubagh and the Khojak, and that Mr. H. R. C. Dobbs, the Offg. Revenue Commissioner, was in correspondence with him, with a view to experimenting with Bee-keeping in Quetta. The members were of opinion that they knew of no reason why the experiment should not prove a success.

26*th August* 1909.

The Honorary Secretary then passed round for inspection:—

(1) A collection of vertebrate fossils, mostly from the Bugti country, which had been kindly identified for the Museum by the Director, Geological Survey of India, Calcutta.

(2) A collection of local butterflies and bugs kindly named by Colonel C. Swinhoe and Mr. Waterhouse of the British Museum.

(3) A wagtail returned by the Honorary Secretary, Bombay Natural History Society, which had been identified by Dr. Hartert of Tring as "a female of *Motacilla citreola* or *citreolades*."

(4) A copy of "Saunder's Manual of British Birds," purchased by the Museum.

(5). A sample (6 inch cube) of Baluchistan marble from the Nahar Nallah, near Quetta, presented by Mr. C. H. Dracott, with an analytical report thereon by Mr. James Cleghorn, Consulting Engineer.

Read letter No. Herb, 275-1-7, dated 17th June 1909, from the Superintendent, Royal Botanic Gardens, Calcutta, identifying a curious horned fruit found at Ahmadkhanzai near Quetta, last March, as *Martynia proboscidea.*

The meeting was then thrown open to the members, and Lieutenant Bignell reported that he had come across several Cicada during the 1st week of August on the top of Tsut hill, a little over 10,000 feet.

There being no further business, Major Goodwin thanked Mr. Dracott for his gift of a sample of Baluchistan marble and for the analytical report he had obtained on it. He then asked the members to do what they could to bring in specimens of the various bugs of the country, many of which were new to science, and reminded them that the birds were once again passing through the country on migration and affording collectors a fresh opportunity of adding to their knowledge of the avifauna of Baluchistan.

30*th September* 1909.

Read list of donations made to the Museum during the month, the exhibits themselves being passed round for the inspection of members except in the case of three very interesting live snakes, a 9 feet Python, a Cobra (in cage) and an *Eryx johnii*, found by Mr. Flynn at the river Habb between Sind and Baluchistan, which were placed on the table and viewed at a respectful distance by some of the members who left their chairs for the time being. Of the other exhibits, the most important were a Beech Marten from the Staff College, presented by Miss Tranaka, a Common Wryneck from Quetta, presented by Lieutenant A. M. Lloyd, and a lot of butterflies from Ziarat, collected and mounted by Mr. B. H. Ford.

Read note from the Hon'ble President, expressing his delight with Mr. Ford's collection of butterflies.

Resolved that the thanks of the members be conveyed to Mr. Ford for his valuable collection of butterflies.

Read appeals published by the Bombay Natural History Society:—

(1) From Mr. E. C. Stuart Baker, asking for information as to the breeding of the rarer species of Grouse with eggs of all species either on loan or as gifts in exchange, and for information as to the dates on which Woodcock, Snipe and Jack Snipe are first and last shot in any part of India, the relative dates of arrival and departure of Fantail and Pintails, and the proportion they form in bags made at different times of the year.

(2) From Professor Powell, of the Northcote Hospital, Bombay, for large Earth Worms, either alive in some of the earth in which found or in methylated spirits.

(3) From Mr. N. B. Kinnear, Keeper of the Museum, Bombay Natural History Society—

(*a*) For beetles common or rare from all over the Indian Empire ; and

(*b*) For information on the migration of birds.

Resolved that members be requested to do what they can to assist in the above directions.

Read letter, dated 13th September 1909, from Mr. James Cleghorn, C.E., Consulting Engineer, Calcutta, to Mr. C. H. Dracott, reporting on the utility of the Baluchistan marble for general building purposes.

Read note by Mr. C. H. Dracott, recording particulars regarding some *Psychidæ* larvæ he had found at Hanna, and specimens of which were passed round for inspection.

Read note from the Hon'ble Sir Henry McMahon, stating that he had ascertained, from the Zoological Society, London, that "Dresser's Birds of Europe," now out of print, was the best standard work on the Birds of Europe, and that he was writing direct to Mr. Dresser, who has a few spare copies, asking the terms on which he would let the Quetta Museum have one.

Read letter, No. 470, dated 16th September 1909, from Mr. Maxwell-Lefroy embodying an interesting report on a specimen of the Lygaeid with pupa skin and fly which was found by Mr. A. A. Flynn in Quetta last May, and had been forwarded to Mr. Lefroy for favour of identification.

In addition to the donations received during the month, the Python (*Python molurus*), Cobra (*Naia tripudians*), and Double Headed Snake (*Eryx johnii*) exhibited alive by Mr. Flynn at the last meeting, and which had since been killed and mounted by Mr. Flynn, were also passed round for the inspection of such of the members who were absent on that occasion : while Mrs. Drake exhibited a curious pair of Markhor horns found on the Murdar Range, in which one of the horns was of the close spiral form after the Sulieman type, and the other had open curls, like that of the Astor type.

Read letter, No. 633, dated 9th October 1909, from Mr. Maxwell-Lefroy, stating it was impossible to identify the *Psychidae* larva presented by Mr. Dracott, but that he would do so later if any of them developed into moths.

The Hon'ble President then concluded the meeting with a few remarks. He suggested that the Samber head and other exhibits, not of local origin, which had been placed in the Museum, be kept apart. He desired that the thanks of the meeting be conveyed to Mulla Alif for the leopard skin he had sent in and expressed a hope that it would not be long before another would be secured. He further referred to the appeals read at the last meeting, and expressed the hope that members would respond by sending in their observations on the arrival and departure, etc., of Woodcock and Snipe, and the migration of birds in general, and expressly asked that advantage be taken of the present shooting season to secure and send in specimens of snipe, grouse, duck, hare, etc.

In conclusion he mentioned that when passing through Bombay on his return from leave, the Honorary Secretary, Bombay Natural History Society, desired him to thank the members of the Baluchistan Natural History Society for their help to the Bombay Natural History Society.

CONTENTS OF THIS NUMBER—(*contd.*).

PAGE

MISCELLANEOUS NOTES—

1. New Langurs from the Indian Empire 978
2. On the food of the Desert Gerbille (*Gerbillus hurrianæ*). By E. Comber 978
3. Tiger attacking a Bear. By Lt.-Col. L. L. Fenton 979
4. A fight between a Panther and a Hyæna. By W. M. F. Pendelbury..................................... 979
5. Mottled Pole-cat (*Putorius sarmaticus*) at Bannu. By Major H. A. F. Magrath 980
6. A good head of Hodgson's Wild Sheep (*With a Plate*). By Capt. F. M. Bailey 980
7. The Serow. By C. B. Moggridge..................................... 981
8. Habits of the Takin..................................... 981
9. A good Chinkara or Indian Gazelle head. By Major R. M. Burton, I.A. 982
10. The Wall Creeper (*Tichodroma muraria*) in Lyallpur. By A. B. Aitken 983
11. Seasonal change of plumage of the Indian White-Eye. By Capt. G. A. Perreau, F.Z.S. (4th Gurkha Rifles) 983
12. Shrikes' Larders. By D. Dewar, I.C.S. 985
13. Common Myna (*A. tristis*) feeding young of Pied Myna (*S. contra*) and nesting habits of the Common Pariah Kite (*M. govinda*) and Brahminy Kite (*H. indus*). By Chas. M. Inglis 985
14. Change of plumage of the Cinnamon Tree-Sparrow (*Passer cinnamomeus*). By Capt. G. A. Perreau, F.Z.S. 986
15. The nesting of a few somewhat rare birds near Mhow. By Lt.-Col. R. M. Betham..................................... 988
16. Birds' Nesting in Garhwal. By S. L. Whymper 990
17. Breeding of the Masked Wagtail (*Motacilla personata*) in Kashmir. By Col. L. L. Fenton 992
18. A note on the nesting of the Besra Sparrow Hawk (*Accipiter virgatus*) and the Andaman Night-Jar (*Caprimulgus andamanicus*) in the Andamans. By P. F. Wickham 992
19. Note on Inglis's Bush Quail (*Microperdix inglisi*, Grant). By Chas. M. Inglis 993
20. Nesting of the Ibis Bill (*Ibidorhynchus struthersi*). By Capt. F. M. Bailey. (*With a Plate*)..................................... 993
21. The Snipe-billed Godwit 994
22. Second occurrence of the Snipe-billed Godwit in Assam. By E. C. Stuart Baker 994
23. Occurrence of the Lesser Florican or Likh (*Sypheotis aurita*) out of Season. By R. K. 995
24. Late breeding of the Indian Little Grebe (*Podicipes albipennis*). By Chas. M. Inglis 995

686

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Carruthers, N. L. M.	Jhansi.
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Chesney, H. G.	Fort Sandeman.
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Clive, Herbert	Myitkyina, U. Burma.
Clutterbuck, P. H. (I.F.S., F.Z.S.)	Naini-Tal, U. P.

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Crawford, Leslie	Bombay.
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Evans, T. M.	Panchgani.
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Evans, Capt. W. H. (R.E.)	Jubbulpore.

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Fagan, H. R.	Rangoon.
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Farrel, R. C. (I.F.S.)	Hyderabad (Deccan).
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Field, Frank	Gulzarbagh, E.I.R.
Field, W. P.	Jalpaiguri.
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Finlay, C. K.	Rangoon.
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Fisher, W. F. D. (I.F.S.)	Belgaum.
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Fitz-Gerald, Capt. O. A. G.	Quetta.
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Moylan, W. M.	... Betul, C. P.
Moysey, E. L. (I.C.S.)	... Bandra.
Muir, G. B. F. (I.C.S.)	... Farrukhabad, U. P
Mudhol, Shrimant Malojirao Raje Ghorpade, Chief of	... Mudhol, S. M. C.
Mullan, J. P. (M.A.)	... Bombay.
Muller, C. H. A.	... Quetta.
Müller, Professor O. V.	... Bombay.
Mullings, C. T.	... Guntur.
Mullins, Bt.-Col. W. B.	... Jullundur.
Mulraj, Lala	... Quetta.
Mumford, J.	... Bombay.
Mundy, B. H. H. (F.R.G.S.)	... Bombay.

Mundy, N. S.	Silchar, Cachar.
Munna Lâl, Dr. (L.M. & S.)	Bara Banki.
Murison, Capt. C. C. (I.M.S.)	*Europe.*
Murphy, Capt. A. (I.M.S.)	Bombay.
Murphy, E. J.	Rangoon.
Murray, Capt. J. H. (I.M.S.)	Port Blair.
Murray, Lt. R. A. C.	Peshawar.
Murray, R. D.	Kasauli.
Murray, S. B. (P.W.D.)	Madras.
Muspratt, Lt.-Col. F. C.	Shau-hai-Kwan, N. China.
Mysore, The Superintendent, Mysore Government Museum	Bangalore.
Mysore, H. H. the Maharaja Krishna Raj Woodayar Bahadoor of (Life Member)	Mysore.
Nahar Singh of Bedla, Rao	Bedlanear, Udaipur.
Nangle, Capt. M. C.	*Japan.*
Napier, A. G. Fitz.	Allahabad.
Napier, A. H. (I.M.S.)	Dera Ismail Khan.
Naranji Dwarkadas (Life Member)	Bombay.
Narrotumdas Morarji Goculdass (Life Member)	Bombay.
Nasrulla Khan, H. H. Nawab Mahomed	Bhopal, C. I.
Nawab Mahomed Salamulla Khan, Khan Bahadur.	Buldana, Berar.
Nene, Sadashive Sitaram	Sangamner, Ahmednagar Dist.
Neale, W. N.	Tankari, Broach District.
Needham, J. E.	Bombay.
Nevill, T. N. C.	*Europe.*
Newbold, Major A. W.	Kohat, Punjab.
Newcome, Lionel	Shanivarsante, P.O. N. Coorg, S. India.
Newnham, Lieut.-Col. A. (F.Z.S.)	Jullundur.
Nicholson, E. F. (F.Z.S.)	*Europe.*
Nicholson, E. H.	Trimulgherry, Deccan.
Nicholson, Major W. C.	Ferozepore.
Nisbet, J. E. S.	Shwebo, Burma.
Nisbett, Major W. G.	*Europe.*
Nizam's College, The Librarian	Hyderabad, (Deccan.)
Noyce, F. (I.C.S.)	*Europe.*
Nurse, Lt.-Col. C. G. (F.E.S.) (Life Member)	*Europe.*
Nuttall, W. M.	Dibrugarh, Assam.
Oakes, M. H. (D.S.P.)	*Europe.*

Oates, E. W. (F.Z.S.) (Hon. Correspg. Member)	*Europe.*
Oberholser, H. C.	Washington, U. S. A.
O'Brien, P.	Thana.
O'Brien, Major Edward	*Europe.*
O'Donnell, O.	*Europe.*
O'Donnell, Lt.-Col. T. J. (D.S.O., R.A.M.C.)	Quetta.
O'Nash, E.	Calcutta.
Ogilvie, A. W. (S.F.S.)	Paknamps, Siam.
Okeden, W. P.	Rangoon.
Oliphant, J.	U. Burma.
Oliver, Lt.-Col. L. G.	Allahabad.
Olivier, Col. H. D. (R.E., F.Z.S.) (Life Member)	*Europe.*
Ollenbach, O. C.	Dehra Dun, U. P.
Orchha, H. H. the Raja Bhagvunt Singji	Tikumgarh, Bundelkhund.
Ormiston, W.	Ceylon.
Orr, Capt. H. M. C.	*Europe.*
Orr, J. P. (I.C.S.)	Bombay.
Osborn, Genl. W.	Naggar Kullu, Kangra District.
Osmaston, A. E. (I.F.S.)	Kheri, Oudh.
Osmaston, B. B. (I.F.S.)	*Europe.*
Osmaston, L. S. (I.F.S.)	Yellapur.
O'Sullivan, Col. D. (R.A.M.C.)	Quetta.
Owen, W. Tudor (I.C.S.)	Palitana, Kathiawar.
Oxley, Capt. J. C. S. (I.M.S.)	Amraoti, Berar.
Packard, Capt. H. N. (R.A.)	*Europe.*
Paddison, G. F. (I.C.S.)	Berhampur.
Page, W. G.	Surat.
Page, W. T. (F.Z.S.)	*Europe.*
Page, W. W. K.	Calcutta.
Painter, H. L. (I.C.S.)	*Europe.*
Palanpur, Shah Zada Taley Mahomed Khan	Palanpur.
Palmer, Capt. C. E. (I.M.S.)	Bombay.
Palmer, W. L. (I.F.S.)	Papan, Burma.
Pandit, S. Prem N.	Jaipur, Rajputana.
Panna, H. H. the Maharaja Mohendra Yadvendra Singh Bahadur	Ajmer.
Panter, Lt. G. A. E.	Jersey, Channel Islands.
Parames, N. V. (C.S.)	Ernakulam, Cochin State.
Parker, R. N. (I.F.S.)	Abbottabad.
Parish, N. B.	Alwar, Rajputana.
Parnell, R. (I.F.S.)	Lahore, Punjab.
Parrington, Lt. J. W. (R.A.)	Kirkee.

Parsons, A. E. B.	Dargai, N.-W.F. P.
Parsons, M. D.	Pyinmana, U. Burma.
Parshotumdas Vishram Maoji	Bombay.
Partridge, E. A.	Secunderabad, Deccan.
Pasco, J. Harding	Kulla Kamby, Nilgiris.
Pasteur Institute of India, The Director	Kasauli, Punjab.
Patel, Khan Bahadoor Burjorji D.	Quetta.
Patiala, H. H. the Maharaja of	Patiala, Punjab.
Patton, Capt. W. S. (I.M.S.)	Guindy, Saidapet.
Patuck, P. S. (I.C.S.)	Wardha.
Pawalla, Jamsetji C.	Bombay.
Payn, Capt. W. A.	*Europe.*
Payne, R. (B.A.)	Bankipur, E. I. Ry.
Pearce, Major C. R. (I.M.S.)	Maymyo, Burma.
Pearless, S. H.	Ceylon.
Pears, S. G. (I.C.S.)	Parachinar.
Pearse, Lt.-Col. J. L.	Dinapore.
Pearson, R. S. (I.F.S.)	Dehra Dun, U. P.
Pechey, W. P.	Bombay.
Peile, Capt. H. D. (I.M.S.)	*Europe.*
Pendlebury, W. M. F.	Jalna, Deccan.
Penton, Lt.-Col. R. H. (R.A.M.S.)	Poona.
Percival, A. P. (I.F.S.)	Mandla, C. P.
Percival, G. S. P.	Mercara, Coorg.
Perreau, Capt. G. A.	Bakloh, Punjab.
Perrot, Lt. H. S. (R.G.A.)	*Europe.*
Pershouse, Lt. S.	*Europe.*
Pestonji Jivanji (N.C.S.) (Life Member)	Hyderabad, D.
Peters, Col. C. T. (I.M.S. retd.)	Dinajpur.
Petit, Bomanji Dinshaw (Life Member)	Bombay.
Petit, Dhunjibhoy Bomanji (Life Member)	Bombay.
Petit, Jehangir Bomanji (Life Member)	Bombay.
Petley, C. A.	Toungoo.
Phillimore, Capt. R. H. (R.E.)	Maymyo, Burma.
Phipson, H. M. (F.Z.S.) (Life Member)	*Europe.*
Phythian, Adams, Lt. E. G. P.	Poona.
Pickersgill-Cunliffe, Lt. J. C.	Jhansi.
Pilcher, Major A. J. (R.E.)	*Europe.*
Pilcher, Col. J. G. (I.M.S.)	*Europe.*
Pile, J.	Secunderabad, Deccan.
Pipe, T. S.	Nasik.
Pinhey, Lt.-Col. A. F. (C.I.E.)	Simla.
Pitt, W. H.	Rajamundri.
Plunkett, P. E.	Katha, U. Burma.

Pollard, G. F. (F.Z.S.)	Dehri Garhwal, U. P.
Polovtsoff, Mons. A.	*Europe.*
Polwhele, A. C. (C.E.)	*Europe.*
Poncins, Baron Edmond de (Life Member)	*Europe.*
Pope, J. A. (I.C.S.)	Satara.
Porter, W. R. S.	Quetta.
Porter, A. A.	Kakon, U. Siam.
Pottinger, Lieut. J. A.	*Europe.*
Pottinger, Major R. S.	*Europe.*
Powalla, Jemsetji C.	Bombay.
Powell, Dr. A.	Bombay.
Powell, J. E.	Gya, Bengal.
Powell, Lt.-Col. S. (M.D., R.A.M.C.)	Rangoon.
Powell, W.	Bombay.
Praed, Lt. G. A. M.	Fort William.
Prall, Lt.-Col. S. E. (I.M.S.)	Aden.
Pratt, H. C.	Selangor, Federated Malay States.
Preston, F. J.	Bombay.
Prideaux, C. C. A.	*Europe.*
Priestley, E.	Thar & Parkar, Sind.
Primrose, Alex. M.	Punkabari, P. O. Duars.
Procter, The Hon'ble Mr. H. E.	Bombay.
Proctor, Capt. Alfred H. (I.M.S.)	Hongkong.
Professor of Forestry, School of Forestry	Oxford.
Punjab Agricultural College, The Principal	Lyallpur, Punjab.
Punjab Government Horticultural Gardens, Supdt.	Lahore.
Purkis, F. C. (B.F.S.)	Rangoon.
Purkis, H. V.	Karna, P. O. Kashmir.

Quin, Capt. R. P.	Cawnpore.
Quinlan, D.	Calcutta.
Quinn, Dr. P. W.	Betul, C. P.

Raikes, E. B.	Bombay.
Rajkumar College, the Principal	Rajkote.
Ralston, Lt. W. H.	Dera Ismail Khan.
Ramsay, N.	Rangoon.
Rattray, Col. R. H.	*Europe.*
Ravenshaw, Col. C. W. (Life Member)	*Europe.*
Readymoney, N. J.	Bombay.
Rebello, Revd. João	Marmagao, Goa.
Rector, St. Mary's College	Mazgaon, Bombay.
Redmond, Rev. J.	Mysore.
Rees, H. C.	Pegu, Burma.

Rees, R.	Chandkhira P. O., Sylhet.
Rees, W. E.	Gaya, Bengal.
Reeve, R.	Bombay.
Reid, Cecil H. (I.C.S.)	Calcutta.
Reid, M. F. (C.I.E.)	Calcutta.
Reid, W. J. (I.C.S.)	Dacca.
Reilly, N. E.	Panjgur, Mekran Coast.
Rendall, H. D. (I.C.S.)	Rajkote.
Rennick, Lt.-Col. Alex. de C.	*Europe.*
Reinhold, Capt. C. H. (I.M.S.)	Kohat, N. W. F. P.
Rennie, Thos. (I.C.V.D.)	Rangoon, Burma.
Reynolds, Capt D. (R.F.A.)	Nowshera.
Reynolds, L. W. (I.C.S.)	Calcutta.
Rhé-Philipe, G. W. V. de	Calcutta.
Rhenius, C. E.	*Europe.*
Rhodes, T. M.	*Europe.*
Richards, B. D. (B. SC.)	Bombay.
Richardson, Lt. G. G.	*China.*
Richardson, H. L.	Bombay.
Richmond, R. D. (I.F.S.)	Coimbatore.
Ritchie, Capt. C. McI. (R.H.A.)	Mhow, C. I.
Ritchie, F.	*Europe.*
Robert, A. W.	Madras.
Roberts, Capt. A. S. B.	Rangoon.
Roberts, Lt.-Col. J. R. (I.M.S.)	Indore, C. I.
Roberts, Major M. B. (Life Member)	*Europe.*
Robertson, B. (I.C.S., C.I.E.)	Calcutta.
Robertson, T. B.	Jacobabad.
Robertson, J. H. (I.C.S.)	*Europe.*
Robertson, L. (I.C.S.)	Bombay.
Robertson, L. V. M. (I.C.S.)	Karachi.
Robinson, H. K. (I.F.S.)	Kurseong.
Rodger, A. (I.F.S.)	Mogok, U. Burma.
Rodon, Major G. S. (F.Z.S.)	Dharwar.
Rogers, A. C.	Bombay.
Rogers, C. G. (I.F.S.)	*Europe.*
Rogers, Capt. F. C. (I.M.S.)	Nellore.
Rogers, J. B. Leslie	Bombay.
Rogers, Rev. K. St. A.	Rabai, East Africa.
Rogers, W. S.	Bombay.
Rogers, A. K.	Barrakpore, Bengal.
Rome, Lt. H. C.	Peshawar.
Rooke, E. A.	Sugdalpur, Bastar State, C. I.
Rorie, J. J.	Toungoo, Burma.
Rose, Col. H.	Dilkhusha, Lucknow.

Ross, J. P.	Bombay.
Ross, Major Tyrell (Life Member)	Dilkhusha, U. P.
Row, Dr. R. (M.D.)	Bombay.
Rowan, Revd. T. (B. D.)	Panchgani.
Rowland, Dr. S.	*Europe.*
Rowlandson, E. J.	Vellore, N. Arcot Dist.
Royal Asiatic Society, The Honorary Secretary	Bombay.
Ruddle, W. H.	Secunderabad.
Rushton, C. E.	Mandalay, Burma.
Russell, A. J.	Banmank, U. Burma.
Russell, Hon'ble Mr. Justice L. P.	*England.*
Rust, P. J. (I.C.S.)	Rupar, Umballa Dist.
Rutherford, W. F.	*Europe.*
Ryan, G. M. (I.F.S.)	Poona.
Rylands, H. R.	*Europe.*
Ryves, A. E.	Allahabad.
Sale, Edward L. (I.C.S.)	Karachi.
Salkeld, Capt. R. E.	*Kismayu, British East Africa.*
Salmon, Capt. W. H. B.	Rawalpindi.
Salt, Capt. H. F. (R.F.A.)	Lahore Cantt.
Samers, W. B. (M.B.)	Rangoon.
Saone, G. Prier De	*Europe.*
Sassoon, Mrs. S. D.	*Europe.*
Saxby, H. B.	Bulsar.
Saunders, Capt. C.	*Europe.*
Saunders, H. F.	Gwalior, C. I.
Saunders, Major F. W. (R.E.)	Bombay.
Savile, L. H.	Bombay.
Scindia, H. H. the Maharaja Sir Madhowrao (G.C.S.I., G.C.V.O.) (Life Member)	Gwalior, C. I.
Schultz, Chas. S.	*Japan.*
Scoresby-Jackson, Dr. T.	Abu Road.
Scot, J. S. (I.F.S.)	*Europe.*
Scott, Edmund	Ceylon.
Scott, Capt. G. B.	Mooltan.
Scott, F. B.	Fort Lockhart.
Scott, R. P.	Bombay.
Scrafton, Lt. J. E. B.	Secunderabad.
Scroggie, Capt. W. R. J. (I.M.S.)	Ganjam, Madras.
Scroope, H. W. P. (I.C.S.)	Dumka, Sonthal Parganas, Bengal.
Seale, Dr. C. E. B.	Darjeeling.
Sealy, Major A. E.	*Europe.*
Sedgwick, L. J. (I.C.S.)	Poona.

Seervai, Dr. Rustom F.	Bombay.
Sirdar, Anandrao Scindia	Gwaliar, C. I.
Service, Geo.	Bombay.
Seton-Karr, H. W. (Life Member)	*Europe.*
Settlement Reading Club, The Principal	Port Blair.
Sewell, J. H.	Rangoon, Burma.
Shah, Aga Cassem	Poona.
Shakespear, Lt.-Col. J.	Manipur State.
Sharp, Hon'ble Mr. W. H.	Poona.
Sharp, H.	Shillong.
Shaw, H. J.	Bombay.
Shaw, Capt. W. S. J. (I.M.S.)	Rangoon.
Sheldon, Dr. J. H.	Toungoo, Burma.
Shebbeare, E. O.	Jalpaiguri.
Shepherd, Philip	Quetta.
Shepherd, W. C. (I.C.S.)	Bijapur.
Shepperson, C. J. W.	*Europe.*
Shipp, W. E.	Ajmer.
Shevade, S. V. (B. SC.)	Kirkee.
Shore, H. A.	Waltair, Vizagapatam District.
Shortland, C. V. N. (A.M.I.C.E.)	Bilaspur, C. P.
Short, Lt.-Col. A. (R.H.A.)	Mhow, C. I.
Shoubridge, H. O. (C.E.)	Nasik.
Silvester, C. J.	Lalmomir Hat, E. Bengal.
Sim, E. L.	Bombay.
Simcox, A. H. A. (I.C.S.)	Jalgaon, Khandesh.
Simcox, Lt. C. T.	Sitapur.
Simonds, M. H.	*Europe.*
Simpson, J. Hope (I.C.S.)	Allahabad.
Simson, Lt. R.	Fyzabad.
Sinclair, R. L.	Surat.
Sind Club, The Hony. Secretary	Karachi.
Sitwell, Capt. N. S. H. (R.A.)	Dum Dum.
Skelton, J. H.	Bombay.
Skilling, W.	Poona.
Skinner, Capt. J. M. (I.M.S.)	Jhelum, Punjab.
Skinner, Capt. R. B. (R.E.)	Dagshai, Simla Hills.
Skinner, R. R.	Fort Bilaspur, U.P.
Slade, Rear-Admiral E. J. Warre	Bombay.
Sladen, Dr. R. J. L.	Bhusawal.
Slater, H. Kelshall	Bangalore.
Slater, J. Sanders	Bombay.
Smallwood, H. St. C.	Thabeitkyn, U. Burma.
Smales, Chas. B. (I.F.S.)	*Europe.*

Smith, Major F. A. (I.M.S.)	Quetta.
Smith, Capt. H. H.	Rangoon.
Smith, Major O. A.	Mooltan.
Smith, S. D. (B.A.)	Bombay.
Smith, W. J.	Colombo.
Smythies, E. A.	Naini Tal.
Somerville, Lt.-Col. T. C. F.	*Europe.*
Somers, W. B. (M.B.)	Rangoon.
Souter, C. A. (I.C.S.)	Madras.
Southon, Capt. C. E. (I.M.S.)	Bombay.
Sowerby, M. H	Bombay.
Sparke, W.	Rangoon, Burma.
Sparling, A. H.	*Europe.*
Spence, A. D.	Rangoon.
Spence, J. R.	Ahmedabad.
Spence, R. A.	Bombay.
Spooner, T. J. (C.E.) (Life Member)	Gadag, S. M. Ry.
Stables, Major Alex. (R.A.M.C.)	*Europe.*
Stack, Mrs. C. E.	*Europe.*
Stallard, R. H. (R.E.)	Sialkot.
Standen, B. (I.C.S., C.I.E.)	Pachmarhi, C. P.
Stanton, W. C.	Cawnpore.
Staples, E. W. H. (C.E.)	Dum Dum.
Stebbing, E. P. (I.F.S., F.L.S., F.E.S., F.Z.S.)	*Europe.*
Steel, Capt. D. (I.M.S.)	Bombay.
Steen, Capt. R. (I.M.S.)	Mainpuri, U. P.
Steffen, O.	*Europe.*
Stephens, L. B.	Karachi.
Stevens, Lt. F. (I.M.S.)	Manipur State, Assam.
Stevens, Herbert	Lakhimpur, Assam.
Stevenson, Capt. W. D. H. (I.M.S.)	Bombay.
Stewart, Capt. G. H. (I.M.S.)	Pegu.
Stewart, J. Lee	*Europe.*
Stewart, Capt. J. M.	Bombay.
Stirling, J. H.	Jodhpur, Rajputana.
Stockley, Capt. J. P.	Kotra, Rajputana.
Stoney, E. W., C.I.E.	Coonoor.
Stoney, R. F.	Madras.
Stonor, W.	Nagasamudram, S. M. Ry.
Storey, Thos. H.	Oodeypur.
Stockley, Capt. C. H.	Belgaum.
Storey, S. S.	Bombay.
Street, E.	Mandalay.
Stringfellow, H. P.	Bombay.
Strong, F. W. (I.C.S.)	Dinajpur, E. Bengal.

Strong, R. P. W.	Bombay.
Stuart, C. J.	Nellore.
Stuart, G. A. D. (I.C.S.)	Saidapet, Madras.
Stuart, J. D.	Mimbu.
Stubbs, L. M. (I.C.S.)	Orai, Jalaun Dist.
Sullivan, Col. G. D. F.	Bombay.
Sullivan, E. H.	Madanapaili.
Summers, Thos. (C.E.)	Karachi.
Surveyor, Dr. N. F. (M.D.)	Bombay.
Suter, Dr. M. F.	Bombay.
Swinhoe, Genl. C.	*Europe.*
Swinhoe, R. C. J.	Mandalay.
Sykes, Major C. A., (R.H.A.)	Bangalore.
Sykes, C. M. (C.E.)	Dhar, C. I.
Sykes, M. G. (I.C.S.)	*Europe.*
Sykes, Sir Tatton, Bart.	*Europe.*
Symes, W. C.	Bombay.
Symons, Lieut. H. (R.G.A.)	Kirkee.
Symons, C. T.	Colombo, Ceylon.

Talbot, W. A. (I.F.S.)	Kirkee.
Tambe, Dr. Gopal Ramchandra (M.A., B.SC., L. M. & S.).	Indore, C. I.
Tanner, Major C. O. O.	Karachi.
Tata, Sir Dorabji J. (Life Member)	Bombay.
Taylor, Capt. J.	Bombay.
Taylor, J. Stopford	*Europe.*
Taylor, James H.	*Europe.*
Tejpal, Goverdhandas Goculdas (Life Member)	Bombay.
Tenison, Lt. W. P. C. (R.F.A.)	Nowshera, Punjab.
Tennant, G. F. D.	*Europe.*
Tew, G. C. (I.C.S)	Pyinmana.
Thom, W. S.	Paletwa, Aracan Hill Tracts.
Thomas, E. F. (I.C.S.)	Palghat, Malabar.
Thomas, F. B.	Kanchrapara, E. B. S. Ry.
Thomasset, H. P.	Cascade, Mahe, Seychelles.
Thompson, Miss A.	Betul, C. P.
Thompson, R. H. E. (I.F.S.)	*Europe.*
Thompson, Major W. G. (R.H.A.)	Hyderabad, Sind.
Thomson, Lt.-Col. Henry (I.M.S.)	Madras.
Thomson, Major D. B.	*Europe.*
Thomson, W. M. (I.M.S.)	*Europe.*
Thornhill, Lt.-Col. H. B. (C.I.E.)	Simla.
Thornton, H. A. (I.C.S.)	Lashio, N. Shan States.
Thornton, Capt. F. E.	Rangoon.

Thorpe, Capt. L. L. G. (R.A.M.C.)	*Europe.*
Thring, Lt.-Col. R. H. D.	Jubbulpore, C. P.
Thruston, L. A.	Mandalay.
Thubron, J. B. S.	Nasik.
Tibbs, Rev. P. G.	Bombay.
Tilly, T. H. (Life Member)	Rangoon.
Tichborne, Sir Henry, Bart.	*Europe.*
Tinley, Col. G. F. N.	Meerut.
Tipper, G. H. (B.A.)	Calcutta.
Tipping, P. G.	Sidapur, Coorg.
Tod, Alex. M.	Bombay.
Todd-Naylor, Hon'ble Mr. H. P. (I.C.S., C.I.E., C.S.I.)	Rangoon.
Tomkins, Major E. L. (R.A.)	Jubbulpore, C. P.
Toppin, S. M. (R. A.)	Drosh, Chitral.
Tottenham, W. F. L. (I.F.S.)	Pokokku, U. Burma.
Townsend, Major E. C.	Akyab, Burma.
Traill, W. H.	*Europe.*
Travancore, H. H. The Maharaja Sir Sultan Rama Raja Bahadoor (G.C.S.I., G.C.I.E.) (Life Member).	Trivandrum.
Trench, C. G. C. (I.C.S.)	Damoh, C. P.
Trevor, C. G. (I.F.S.)	*Europe.*
Trevor, Surg.-Genl. F. W. (R.A.M.C.)	Calcutta.
Trivandrum, The Director, Government Museum and Public Gardens	Trivandrum.
Trotter, E. W.	Bangkok, Siam.
Troup, N. F. T.	Kousanie, P. O. Almora, U. P.
Truninger, L.	Calcutta.
Turkhud, Dr. D. A.	Satara.
Turner, Sir Montague	*Europe.*
Tweedie, A. G.	Calcutta.
Tweedie, Lt. J. L.	*Cairo.*
Twiss, Lt. A. M. (R.E.)	Kirkee.
Tyabji, S. B.	Hubli.
Tyler, H. H. F. M. (I.C.S.)	Waltair, Vizagapatam Dist.
Tyrrell, Major J. R. (I.M.S.)	Sirdarpore, C. I.
Tytler, Maj. H. C.	*Europe.*
Uehlinger, H.	Bombay.
Ulwar, H.H. Maharaja Sawai Jaisingh Bahadoor (Life Member)	Ulwar, Rajputana.
United Service Club, The Secretary	Bangalore.
United Service Library, Hon. Secretary	Poona.
Unwalla, J. N. (Life Member)	Bhavnagar.
Urwin, Capt. J. J.	Motihari, B.N.Ry.
U. S. Department of Agriculture, The Librarian	*Washington D. C.*

Vanrenen, Capt. D. H.	Lyallpur.
Vaughan, W. (F.E.S.) (Life Member)	Ceylon.
Venning, F. E. W. (Life Member)	Haka, Chin Hills, Burma.
Venour, Major W. E. (I.A.) (Life Member)	Kohat.
Vernon, C. V. (I.C.S.)	Hyderabad, Sind.
Vernon, H. A. B. (I.C.S.)	Madras.
Victoria College, The Principal	Palghat.
Victoria Technical Institute, The Curator and Librarian	Nagpur.
Vincent, W. H. H. (I.C.S.)	Calcutta.
Vipan, Alfred	Bezwada.
Vithuldas Damodhar Thakersey, The Hon'ble Sir	Bombay.
Waddington T. H.	Phillaur, Punjab.
Wadeson, Col. F. W. G.	Jacobabad, Sind.
Wadia, D. N. (Prof. of Biology, P. W. College, Jammoo)	Kashmir.
Wainwright F. M.	Gudivada, Kistna
Waite, H. W.	Delhi.
Walker, Major G. K. (A.V.D.)	London.
Walker, J. S. E.	Purnahia, Benga
Walker, Capt. W. B. (R.A.)	Quetta.
Wall, Major F. (I.M.S., C.M.Z.S.)	Chitral.
Wallace, John (C.E.)	Bombay.
Wallace, R.	Bombay.
Wallace, W. V. (I.C.S.)	*Europe.*
Wallinger, W. A.	Satara.
Wallis, R. W. D.	Mingin, Upper Chindwin, Burma.
Walsh, E. P. (I.C.S.)	*Europe.*
Walton, Major H. J. (I.M.S., C.M.Z.S.)	*Europe.*
Warburton, H. G. (I.C.S.)	Lucknow.
Ward, Col. A. E.	Bareilly.
Ward, Major C. H.	Fort Sandeman.
Ward, W.	Ootacamund.
Wardrop, Capt. A. C.	Mhow, C. I.
Wasey, G. K.	*Europe.*
Waterfield, E. H. (I.C.S.)	*Europe.*
Watney, C. W.	*Europe.*
Watson, Capt. H. R.	Bangalore.
Watson, H. W. A. (I.F.S.)	Taunggyi, Burma.
Watson, Capt. J. W. (I.M.S.)	Turbat-i-Haideri.
Watson, Col. W. A. (C.I.E.)	Goona, C. I.
Watson, W. M.	*Europe.*
Watts, Capt. G. A. R.	*Europe.*
Watts, Lt. N. H. L.	Mandalay, Burma.
Webb, G. R.	Bombay.

Webb, M. (I.C.S.)	Shikarpur, Sind.
Webster, Sub.-Lieut. D. (R.N.)	East Indies Station.
Weldon, W. L.	Bombay.
Wellborne, C. de M.	Deolali.
Weller, A. O.	Kanchrapara, E. B. S. Ry.
Wells, F. W. A.	Pyawbwe, U. Burma.
Wells, Capt. R. T. (I.M.S.)	Bombay.
Welman, P. H.	Bombay.
Wenden, H. (C.E., C.I.E.)	*Europe.*
Weston, A. T.	Hminelongyee, L. Burma.
Weston, W. V.	Gonate, *via* Sainthia, E. I. Ry.
Whalley, P.	Rangpur.
Whately, Richard	Abu Road, R.-M. Ry.
Wheatley, Major P. (R.F.A.)	Mhow, C. I.
Whiffin, F. D.	Rourkela, B.-N. Ry.
Whitcombe, Major E. G. R. (I.M.S.)	*Europe.*
White, Lt. A. W.	Jask, P. Gulf.
White, C. R.	Shwebo, Burma
White, Chas. W.	Bombay.
White, C. A.	Taraghur.
White, W. T.	Rangoon.
White, W. P.	Bhandara, C. P.
Whitehead, Lt. C. H. T.	Sehore, Bhopal.
Whitehead, John (I.F.S.)	Jhansi, U. P.
Whitehead, Major J. H.	Mandalay.
Whittall, Lieut. G.	Thayetmyo.
Whittall, Brigade-Col. F. V.	Bolarum, Deccan.
Whitworth, G. C. (Life Member)	*Europe.*
Whymper, S. L.	Jeolikote, U. P.
Wickham, H. C.	*Europe.*
Wickham, P. F. (C.E.)	Rangoon.
Wigram, Major H.	Srinagar, Kashmir.
Wiles, G. (I.C.S.)	Broach.
Wilkinson, Capt. A. C.	Rawal Pindi.
Williams, A. (I.C.S.)	Quetta.
Williams, Major C. E. (I.M.S.)	Maymyo.
Williams, J. K.	Bijapur.
Williams, Stanley Price	Bannu, N. W. F. P.
Williamson, K. B.	Jubbulpore, C. P.
Williamson, W. J. F.	Bangkok, Siam.
Willis, R. A.	Bombay.
Willock, Comr. A. R. G. (R.I.M.)	*Europe.*
Wilson, Major Alban	Shillong, Assam.
Wilson, A. R.	Almora, U. P.

Wilson, A. T.	Muhammareh, Persian Gulf.
Wilson, Lt.-Col. C. H. L. F. (R.A.)	*Europe.*
Wilson, H. C.	Madras.
Wilson, R. A. (I.C.S.)	Khandwa.
Wilson, William Burns	*Europe.*
Wimbush, O. C. B.	Bombay.
Winsor, D. W.	Sirur, Poona.
Withinshaw, L.	Ramnad.
Witt, D. O. (I.F.S.)	Saugor, C. P.
Wood, C. W. (C.E.)	*Europe.*
Wood, Capt. H. (R.E.)	Poona.
Wood, Major H. S. (I.M.S.)	Calcutta.
Wood, R. B. M.	Bhamo, Burma.
Woodhouse, E. J.	Bhagalpore.
Wooster, W. G.	Yawng Hwe, S. Shan States.
Wright, A. J.	*Europe.*
Wright, Major E. H. (I.M.S.)	Tanjore.
Wright, F. A. (C.E.)	Calcutta.
Wright, H. C.	*Europe.*
Wright, J. M. (I.C.S.)	Shwegu, Burma.
Wright, R. R.	Calcutta.
Wright, W. D. (I.M.S.)	Ahmednagar.
Wrigley, F. A.	Rangoon.
Wroughton, R. C. (F.Z.S.) (Life Member)	*Europe.*

Yeo, Edwin W.	Bombay.
Yerbury, Col. J. W. (R.A.) (Life Member)	*Europe.*
Younan, Lt.-Col. A. C. (I.M.S)	Multan.
Young, E. H.	Ajmer.
Young, F. B.	*Europe.*
Young, J. V. (I.F.S.)	Pyinmana, Burma.
Young, Capt. M. J. D.	Secunderabad, Deccan.
Yule, Capt. R. A.	Hyderabad, Deccan.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT OF ACCOUNTS (from 1st January 1908 to 31st December 1908).

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
Balance in Bank on 1st January 1908 ...	9,515	0	4			
Cash in hand on do. ..	155	12	0			
Petty Cash Balance on 1st January 1908	43	14	0	9,714	10	4
Subscriptions for 1905 (in arrears) ...	30	0	0			
Do. 1906 (do.) ...	90	0	0			
Do. 1907 (do.) ...	803	8	6			
Do. 1908	14,456	15	9			
Do. 1909 (in advance) ...	903	5	0			
Do. for Life Membership ...	811	0	0	17,094	13	3
Entrance Fees				1,480	0	0
Sale of back Journals, &c.				1,761	3	0
Subscriptions for the book on "Indian Ducks and their allies" published by the Society				18,426	5	10
Grant from the Government of Bombay for 1908 ...				5,000	0	0
Sundries				3,111	14	3
Interest on Government Paper				549	14	3
Interest allowed by Bank				156	3	9
Miscellaneous receipts...				1	11	0
Total ... Rs.				57,296	11	8

EXPENDITURE.	Rs.	a.	p.	Rs.	a.	p.
Rent of the Rooms from 1st December 1907 to 30th November 1908 including electric lights and fans ...				1,680	0	0
Salaries.—						
Keeper of the Society's Museum (Mr. N. B. Kinnea) from 1st December 1907 to 30th November 1908	3,650	0	0			
Salaries of the Staff from 1st December 1907 to 30th November 1908	2,547	13	8	6,197	13	8
Postage on Journals and Snake books, &c.				1,691	7	3
Printing and Stationery				2,861	15	1
Part of expenses incurred in publishing the book on "Indian Ducks and their allies"—						
Messrs. Taylor and Francis (Printing)..	2,370	8	6			
Mr. James Green, (Coloured Plates) ...	8,484	0	10			
Mr. R. H. Porter, (Binding) not yet closed	...	..		....		
Printing Circulars, &c.	48	4	6			
Postage	419	8	6			
Packing and Sundry expenses	272	13	0	11,595	3	4
Journal Account. Cost of Printing Journal and Coloured Plates from England and litho-plates and blocks ...				12,979	13	10
Library Account				410	4	3
Furniture Account				933	7	1
General Charges				2,279	12	11
Banks Charges				77	6	0
Sundries				863	2	10
Investments				10,898	0	3
Balance in Bank on 31st December 1908	Rs. 4,623	0	9			
Cash in hand on do. ...	,, 117	9	0			
Petty Cash Balance do. ...	,, 51	9	11			
Postage Balance do. ...	,, 36	1	6	4,828	5	2
				57,296	11	8

Examined and found correct.
(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants.

BOMBAY, 17*th March* 1909.

(Sd.) L. H. SAVILE,
Hony. Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS (from 1st January 1909 to 31st December 1909).

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
Balance in Bank on 31st December 1908 ..	4,623	0	9			
Cash in hand on 31st December 1908	117	9	0			
Petty Cash Balance	51	9	11			
Postage Balance	36	1	6	4,828	5	2
Subscription for 1905 (in arrears) ...	15	0	0			
" 1906 " ...	45	0	0			
" 1907 " ...	195	0	8			
" 1908 " ...	590	14	6			
" 1909 " ...	16,831	8	4			
" 1910 (in advance) ...	1,444	12	0			
" 1911 " ...	15	0	0			
" 1912 ...	11	8	0			
" for Life Membership ...	601	8	0	19,750	2	10
Entrance Fees				2,770	0	0
Government of Bombay grant-in-aid				5,000	0	0
Sundries				4,553	2	3
Sale of back Journals				2,919	12	11
Sales of Duck Book and Plates...				6,116	4	0
Interest on Investments...				922	2	2
Interest allowed by Bank				141	1	6
Total .. Rs. ...				47,000	14	10

EXPENDITURE.	Rs.	a.	p.	Rs.	a.	p.
Rent of the Rooms from 1st January to 31st December 1909 ..				1,740	0	0
Salaries of the Staff do. do. ...				7,561	1	10
Postage				1,562	0	0
Printing and Stationery				3,074	3	5
Journal Account				13,365	9	2
Library "				497	5	10
Furniture "				401	4	0
General Charges				2,603	11	6
Investments				9,822	5	1
Sundries				3,836	8	2
Bank's Charges				79	9	0
Balance in Bank on 31st December 1909	2,253	10	5			
Petty Cash Balance on 31st December 1909	23	14	5			
Postage on 31st December 1909 ...	0	12	0			
Cash in hand on 31st December 1909	179	0	0	2,457	4	10
Total ... Rs. ...				47,000	14	10

Examined and found correct.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants.

(Sd.) L. H. SAVILE,
Hony. Treasurer.

BOMBAY, 17*th May* 1910.

BOMBAY NATURAL HISTORY SOCIETY.

SUPPLEMENTARY CATALOGUE

OF

BOOKS

IN THE

SOCIETY'S LIBRARY.

May 1910.

The following is a list of books, under subject heads, added to the Library since the publication of the General Catalogue of March 1908

Section 12.—Journals, Proceedings, etc., etc., however, is given in full, as very many additions have been made and many previously incomplete series completed in this Section.

As an appendix, is given a more detailed list of certain series in Section 12.

(*Compiled by the Honorary Librarian.*)

PART III.

BOOKS UNDER SUBJECT HEADS.

Page.
I.—Mammals xlix
II.—Birds xlix
III.—Reptiles l
IV.—Fishes... l
V.—Insects li
VI.—Other Invertebrates li
VII.—Geology and Mineralogy lii
VIII.—Botany, Agriculture and Forestry lii
IX.—Biology, Anatomy and Medical Subjects ... liv
X.—Sport and Travel liv
XI.—General and Miscellaneous lv
XII.—Journals, Proceedings, and Memoirs of Societies, Reports, Magazines, etc., etc. ... lv

APPENDIX.

Detailed List of certain Series of Publications given in Section XII ... ... lxv to lxxiv

I.—MAMMALS.

Animal Sketches. C. L. Morgan. 1891.

Asiatic Horns and Antlers in the Indian Museum, Catalogue of. T. Bentham. 1908.

Mammals. See under following series given in the appendix :—

1. Annales du Musée du Congo Belge.
5. British Museum.
9. Indian Museum.
10. United States National Museum (Smithsonian Institution).
11. United States Department of Agriculture.

II.—BIRDS.

Birds of Burma. H. H. Harington. 1909.

,, ,, Calcutta. F. Finn.

,, ,, the Plains. D. Dewar. 1909.

,, that eat Scale Insects. W. L. McAtee. 1906.

Bombay Ducks. D. Dewar. 1906.

Ecdysis as Morphological Evidence of the Original Tetradactyle Feathering of the Bird's Forelimb. E. Degin. (Trans. Zool. Soc. London. 1903.)

Geese of Europe and Asia. F. Alphéraky. 1905.

Indian Ducks and their Allies. E. C. Stuart-Baker. 1908.

Migration, Recensio Critica Automatica of the Doctrine of Bird. O. Herman.

Ornithological Congress, Proceedings of the 4th International. London. 1905.

World's Birds. F. Finn. 1908.

Birds. See also under the following series given in the appendix :—

1. Annales du Musée du Congo Belge.
5. British Museum.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)
11. United States Department of Agriculture.

III.—REPTILES.

Ophidia in Collection of Indian Museum, Notes on. Maj. F. Wali. 1909. (Records, Indian Museum.)

Poison of Venomous Snakes and methods of preventing death from their Bite. Reprinted Papers by Sir J. Fayrer, Sir L. Brunton and Major L. Rogers. 1909.

Sea-snakes, Monograph of the. Major F. Wall. (Mem., Asiat. Soc., Bengal. 1909).

Venoms, Venomous Animals and Antivenomous Serum-Therapeutics. A. Calmette. 1908.

Reptiles. See under following series given in the appendix :—

1. Annales du Musée du Congo Belge.
5. British Museum.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)

IV.—FISHES.

Angler in Northern India. 'Skene Dhu'. 1910.

Angler's Handbook. (Northern Punjab Fishing Club). G. H. Lacy. 3rd ed., 1895.

Board of Agriculture and Fisheries. Annual Report of Proceedings under Acts relating to Sea-Fisheries, 1906.

Ceylon Marine and Estuary Fishing. A. H. Pertwee.

Fish and Fisheries of the Fresh Waters of India, Report on. F. Day. 1871.

Fisheries of Bengal, Enquiry into. K. J. Gupta.

International Fisheries Exhibition. London. 1883.

Indian Fish and Fishing. F. Day.

Indian Section Catalogue. F. Day.

Pisciculture et d'Hydrobiologie, Station de L'Universeté de Toulouse. Bulletins 1-4. 1903-06.

Sea Fishing,—A Lecture. Dr. Travis Jenkins. 1909.

Fishes. See also under following series given in the appendix :—

1. Annales du Musée du Congo Belge.
5. British Museum.
9. Indian Museum.
10. United States National Museum (Smithsonian Institution.)

V.—INSECTS.

Anatomie de la tête du Lasius Niger. C. Janet. 1905.

Fourmis. A Forel.

Fourmis de Barbarie et de Ceylon. A. Forel. 1909.

Fourmis de Costa Rica. A. Forel.

Fourmis de Ceylon et d'Egypte. A. Forel.

Fourmis, Observations sur les. C. Janet. 1904.

Hymenoptera new to Ceylon. O. S. Wickwar. 1908

Indian Insect Life. H. Maxwell Lefroy. 1909.

Insects. Various Papers on C. Janet.

Insects. Various Papers on A. Forel.

Larva of Prodenia synstictis. T. B. Fletcher. 1908.

Mutation in Mosquitoes. S. E. Weber. 1907.

Notes. C. Janet.

Plume Moths from Ceylon, Description of a new. T. B. Fletcher. 1907.

Plume Moths of Ceylon. T. B. Fletcher. 1909.

Priority and Practical Entomology. H. Maxwell Lefroy. 1908.

Insects. See also under following series given in the appendix :—

1. Annales du Musée du Congo.
2. Agriculture, Department of, Bombay. Bulletins.
3. Agriculture, Department of Land Records and, Bombay. Bulletins.
4. Agricultural Research Institute, Pusa.
5. British Museum.
6. Forest Bulletins.
7. Forest Pamphlets.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)
11. United States Department of Agriculture.

VI.—OTHER INVERTEBRATES.

Ariophanta Dalyi. W. T. Blanford.

Crustacea and Arachnids. Cambridge Nat. Hist. Series, vol. iv. 1909.

Descriptions of nine species of Ennea and Five Helicoids from S. Africa. J. C. Melvill and J. H. Ponsonby. 1909. (Annals and Mag. of Nat. Hist.)

Eurystoma of Albers, Anatomy of genus. Lt.-Col. H. Godwin-Austen. 1904.

Freshwater Cyclops of Long Island. E. F. Byrnes. 1909.

Helix politissima of Ceylon, Anatomy of. Lt.-Col. H. Godwin-Austen. 1901.

Helix Basileus from Southern India. Lt.-Col. H. Godwin-Austen.

Marine Mollusca obtained among the Islands of the Indian Ocean. J. C. Melvill. 1909. (Lin. Soc. Trans.)

Marine Zoology of Okhamandal in Kathiawar. J. Hornell. Pt. 1, 1909.

Mollusca. W. T. Blanford and Lt.-Col. H. Godwin-Austen. (Fauna of British India Series.) 1908.

Moluques, Rapport sur les. R. D. M. Verbeek. 1908. 1 vol. and Map.

Invertebrates, Other. See also under following series given in the appendix :—

5. British Museum.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)

VII.—GEOLOGY AND MINERALOGY.

Sketch of the Mineral Resources of India. Sir T. H. Holland.

Geology. See also under following series given in the appendix :—

1. Annales du Musée due Congo.
5. British Museum.
8. Geological Survey of India.
10. United States National Museum. (Smithsonian Institution.)

VIII.—BOTANY, AGRICULTURE AND FORESTRY.

Agriculture, Indian, Report on introduction of Improvements into, by the work of the Agricultural Departments. 1909.

Agriculture in Japan. Sir F. A. Nicholson. 1907.

Algæ of Ceylon, A Contribution to the Freshwater. W. West and G. S. West. (Trans. Lin. Soc. Lond. 1902.)

Algæ of East India, Freshwater. W. B. Turner. 1892.

Armillaria mucida, Fructification of. Note. C. E. C. Fisher. 1909.

„ „ Biology of. „ „ „ 1909.

Botany, Manual of, for Indian Forest Students. R. S. Hole. 1909.

Botanic Terms, Glossary of. R. L. Heinig. 1899.

Flowering Plants and Ferns, Manual and Dictionary of the. J. C. Willis. 1908.

Flowering Plants of Baluchistan, Working list of the. I. H. Burkill. 1909.

Forest Flora of the Berar Circle. D. O. Witt. 1908.

Forest Law, Manual of. 1906.

Forest Report of Pegu, Preliminary. S. Kurz. 1875.

Forest Utilisation, Indian. R. S. Troup. 1907.

Forest Zoology for India, Manual of. E. P. Stebbing.

Indian Plants, Glimpses into the Life of. I. Pfleiderer. 1908.

Indian Plants and Drugs. K. M. Nadkarni. 1908.

New Zealand, Manual of the Flora of. T. F. Cheesman. 1906.

Orchids of Burma. B. Grant. 1895.

Palme incluse nel genere Cocos. Linn. O. Beccari. 1888.

Palme nuove Papuane. O. Beccari.

Palms, Popular History of. B. Seeman. 1856.

Pestalozzia Hartigii, Tubeuf, Note on Biology of. C. E. C. Fischer. 1909.

Pollination of certain Species of Dendrobium. A. F. G. Kerr. 1909. (Scientific Proceedings, Roy. Dublin Society.)

Potatoes grown in the Central Provinces, Varieties of. G. Evans. 1908.

Reliquiæ Schefferianæ. Illustrazione di alcune Palme viventi nel Giardino-Botanico di Buitenzorg. O. Beccari. 1885.

Ring Disease of Potatoes. L. C. Coleman. 1909. (Mysore State Dept. Agric. Bulletin).

Royal Botanic Garden. Calcutta.

Vol. xi. With Plates. Species of Calamus. O. Beccari. 1909. Asiatic Palms.

Sylviculture, Concise Manual of. 1906.

Botany and Agriculture. See also under following series given in appendix :—

1. Annales du Musée du Congo.
2. Agriculture, Department of, Bombay. Bulletins.
3. Agriculture, Department of Land Records and, Bombay. Bulletins.
4. Agricultural Research Institute, Pusa.

5. British Museum.
6. Forest Bulletins.
7. Forest Pamphlets.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)
11. United States Department of Agriculture.

IX.—BIOLOGY, ANATOMY AND MEDICAL SUBJECTS.

Bombay Medical Congress. 1909. Transactions.

Development of Flagellated Organisms from the Parasite of Oriental Sore. R. Row. 1909.

Development of the Parasite of Oriental Sore in Cultures. R. Row. 1909.

Indian Plants and Drugs. K. M. Nadkarni. 1908.

Medicine and Surgery in the Orient—Early days of the American Surgical Association. J. E. Mears. 1908.

Biology, etc. See also under the following series given in the appendix :—

9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)

X.—SPORT AND TRAVEL.

Angler's Handbook. (Northern Punjab Fishing Club.) G. H. Lacy. 3rd edition, 1895.

Big Game Shooting in Cooch Behar, Thirty-seven years of. H. H. Maharaja of Cooch Behar. 1908.

Big Game, Records of. R. Ward. 1907.

Ceylon. E. Schmidt.

Collectors, Handbook of Instructions to. British Museum.

Hindu Koh : Wanderings and Wild Sport on and beyond the Himalayas. D. Macintyre. 1889.

Naturalist's Voyage round the World. C. Darwin. New edition. 1890.

Sport in the Highlands of Kashmir. H. Z. Darrah. 1898.

Three months leave in Somaliland. J. E. Francis. 1895.

Three Voyages of a Naturalist. M. J. Nicholl. 1908.

XI.—GENERAL AND MISCELLANEOUS.

Agglutinants of all kinds. H. C. Standage. 1907.

Castes and Tribes of Southern India. E. Thurston. 1909. 7 Vols.

Ceylon. E. Schmidt.

Commercial Products of India. Sir G. Watt. 1908.

Craniological data of the Indian Museum. 1909.

Darwinism. A. R. Wallace. 1890.

Darwin-Wallace Celebration. (Lin. Soc. Lond.) 1908.

Description du Matériel d'une petite Installation Scientifique. 1re partie. C. Janet. 1903.

Making of Species. D. Dewar and F. Finn. 1908.

Nomenclature of Colours. R. Ridgway. 1886.

Origin of Species. C. Darwin. 1878.

Pearls and Parasites. A. E. Shipley. 1908.

Records of Big Game. R. Ward. 1907.

Seychelles Islands, Unpublished Documents on the History of the. 1909.

General. See also under following series given in appendix :—

1. Annales du Musée du Congo.
5. British Museum.
10. United States National Museum. (Smithsonian Institution.)
11. United States Department of Agriculture.

XII.—JOURNALS, PROCEEDINGS, MEMOIRS, Etc., OF SOCIETIES, REPORTS, MAGAZINES, Etc., Etc.

Academy of Science of St. Louis. Transactions. Vol. xv-xvii. 1905-1907 and various odd parts.

Agriculture, Department of, Bombay.

Annual Report of Experimental Farms in the Bombay Presidency. 1905.

Annual Reports of Experimental work. 1906-07.

Annual Report of Agricultural and Botanical Stations in the Bombay Presidency. 1905-06.

Bulletins Nos. 27, 29, 31, 32. (*v. Appendix.*)

Season and Crop Report, 1904-09.

Agriculture, Department of, India.

Annual Reports. 1904-07.

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        v. appendix.
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Museum, Madras Government. *v. Madras.*

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APPENDIX.

DETAILED LISTS OF THE FOLLOWING SERIES OF PUBLICATIONS.

1. Annales du Musée du Congo Belge.
2. Agriculture, Department of, Bombay. Bulletins.
3. Agriculture, Department of Land Records and, Bombay. Bulletins.
4. Agricultural Research Institute, Pusa.
5. British Museum.
6. Forest Bulletins.
7. Forest Pamphlets.
8. Geological Survey of India.
9. Indian Museum.
10. United States National Museum. (Smithsonian Institution.)
11. United States Department of Agriculture.

1. ANNALES DU MUSÉE DU CONGO BELGE.

A.—Minéralogie, Géologie, Paléontologie.

Serié I. Généralités I. Description des miner aux du Congo Belge.

Serié II. Katanga.

Carte Géologique du Katanga. 1908.

B.—Botanique.

Serié I. Iconographies.

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Tome 1. (Fas. 2-4 only). 1898-1902.

Serié II. Généralités.

Contributions à la Flore du Congo. Tome I. 1899-1900.

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Serié V. Bas et Moyen Congo.

Études de Systématique et de Géographie Botanique sur la Flore du Bas et du Moyen Congo.

Tome i. 1903-06. (Fas. 2 and 3 only).

Tome ii. 1907-08.

Tome iii. Fas. 1. 1909. (in issue).

Notes Botaniques Sur la Region du Bas et Moyen Congo. fasit.

C.—Zoologie.

Serié I. Poissons, Batraciens et Reptiles.

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Tome i. Poissoux Nouveaux. 1898-1900 (fas. 3-4 only).

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Serié II. Mammiferes.

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Tome i. Okapia. 1907.

Serié III. Arthropodes.

Section I. Faune Entomologique de l' Afrique tropicale.

A.—Hémiptères. Fas. 1 and 2. 1903-05.

B.—Coléoptères. Fas. 1 and 2. 1903-04.

Section II. Catalogues raisonnés de la Faune. Entomologique du Congo Belge.
Tome i. Fas. 1. Hémiptères, 1909.
Tome ii. Fas. 2. Coléoptères. 1909.

D.—Ethnographie et Anthropologie.
Serié III. Ethnographié.
Notes analytiques sur les collections Ethnographiques du Musée du Congo.
Tome iii. Fas. 1. La Céramique. 1907.
Documents Ethnographiques concernant les populations du Congo Belge.
Tome I. Fas. 1. Notes Sur la Vie familiale et juridique de quelques populations du Congo Belge. 1909.
Serié V. Linguistique.
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Notices sur des Plantes utiles ou intéressantes de la Flore du Congo. E. de Wildeman. Vol. i and ii. 1903-08.

2. AGRICULTURE, DEPARTMENT OF BOMBAY.

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27. Rice grasshopper. J. B. Knight and R. M. Dixon. 1906.
29. Preliminary Note on Bombay Cottons. F. Fletcher. 1907.
31. Establishment and Management of the Dairy Farm. G. K. Kelkar. 1908.
32. Locusts in India. H. M. Lefroy. 1908.
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3. AGRICULTURE, DEPARTMENT OF LAND RECORDS. BOMBAY.

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20. Cultivation of Betel Palm, Cardamom and Pepper in Kanara District. J. W. Mollison. 1900.
21. Manual Power Tillage Implements. J. W. Mollison. 1900.
22. Pricklypear and Aloe as fodder for Cattle during scarcity. P. R. Mehta. 1904.
25. Sugar-cane. J. B. Knight. 1905.
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4. AGRICULTURAL RESEARCH INSTITUTE, PUSA.

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4. Fruit Experiments at Pusa. 1st Report. 1906.
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Series ix. Jurassu Fauna of Kach. Vol. i, vols. ii and iii in issue.

Series iv. Indian Pretertiary Vertebrata. Vol. i.

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9. INDIAN MUSEUM.

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Index to Volume XVIII.

PAGE
abbotti ... 359
Abelia ... 379, 484
Abies ... 79, 143
Abisara... 21, 38, 39, 474, 567
Ablabes... 338, 350, 351, 549, 557
ablatus... 516
Abrornis ... 124
Aorus... 578
absoluta ... 511
abutiloides ... 684
Abutilon ... 170, 323, 693
abyssinica ... 166
Acacia 31, 64, 65, 171, 173, 319, 325, 480, 524, 569, 575, 579, 640, 662, 855
Acalypha ... 330
Acanthaceæ 158, 167, 328, 387, 388, 391, 489, 575, 577, 642, 643, 868, 874, 876, 878
Acanthis ... 913
Acanthopneuste ...124, 142, 146, 754
acaulis ... 329
Accentor ... 911
Accipiter ... 308, 918, 992, 999
Accipitres ... 308
Acer ... 143, 477
acerifclium ... 59
acetosella ... 476
Achyranthes ... 160, 329, 491
Achyranthus ... 578
acida ... 167
acidissima ... 80, 964
aconitifolius ... 165
Acorus ... 501
Acræinæ ... 39, 40, 41, 566, 647
Acridotheres ... 126, 361, 906
Acridrüdæ ...1007
Acrocephalus ... 144, 146
Acrogonia ... 724
acrosema ... 601
Acrotelsa ... 1005, 1006, 1007
acteus ... 760
Actinodaphne ... 329
Actinodura ... 118

PAGE
aculeata ... 63, 411, 419, 420, 711
aculeatum ... 181
acuminata ... 72, 692
acuta ... 313, 323, 546, 750, 922
acutangula ... 69
acutifolia ... 72
acutipennis ... 435
acutirostris ... 916
acutum ... 484
Adelura ... 910
Adenoon ... 326
adenostemma ... 326
Adhatoda ...328, 391, 489, 577
Adiantum ... 179, 332
Adimonia ... 333
adscendens ... 500
adscenscicnis ... 164
Æcmanthera ... 387
Ædogonium ... 762
aëdon ... 360
ægagrus ... 208
Ægialitis ... 920
Ægithaliscus ... 110, 903
Ægithina ... 120, 359
Ægle ... 81
ægyptiaca 158, 159, 164, 166, 172, 394, 711, 944
Æluropus ... 164
ænea ... 308, 365
Ænopopelia ... 365
Ænothera ... 483
æralatus ... 120
æraria ... 605
Ærides ..139, 140, 141, 330, 498, 499, 624
Ærua ... 160, 172, 329, 491, 956
æruginosus ... 308, 918
Æsalon ... 919
Æsculus ... 143, 477
æstivosa... 370
Ætherastis ... 422
Æthiopsar ... 126, 361
Æthopyga ... 302, 303
affine ... 498, 499

PAGE
affinis 128, 144, 146, 202, 209, 305, 361, 363, 530, 692, 747, 882, 884, 895, 896
africana 429, 952
agamemnon 567, 569
Agamidæ 783
Aganosma 48
Agave 579
Agenora... 722
Ageratum 326
agitata 589
Aglaia 658
aglea ... 41, 44, 45, 46, 48, 53, 54
agrestis 326
Agrimonia 481
agrionidæ 736
Agropsar 906
Ailanthus 81
Ainsliæa 485
alata 484, 487, 688
alatum 329, 477, 491, 721
alatus 170, 388, 489
Alauda 302, 362, 916
Alaudidæ 302, 916
alaudarius 365, 919
alba ... 61, 143, 157, 217, 302, 330, 333, 365, 377, 495, 498, 499, 578, 580, 915
albiceps... ... ... 893, 894
albicilla... 127
albicinctus 126
albicollis 128, 312
albicristatus 796
albida 478, 947
albidum... 939
albiflora 477
albipennis 313, 366, 995
albirostris 209, 306, 363, 549
Albizzia... 65, 66, 325, 480, 662, 855
albo-cœrulea 328
albocinctus ... 348, 559, 758, 791, 830, 845, 897, 898
album 491, 492
albus 499
Alcedinidæ 224, 305, 917
Alcedo 363, 305, 917
alchata 549
Alcides 1007
Alcippe. ... 116, 644, 650, 1017
alcippus 44, 52
alcippoides 52

PAGE
Alcurus 121
Alcyonaria 227
Aletyris... 500
Alhagi 171, 689
Allium 161, 166, 500
Allophylus 319, 325
almana ...36, 566, 642, 651, 871, 873, 876
aloides 939
alopecuroides 773
alpigena 382
Alpina 475
alpinus... 902
Alseonax ... 127, 361, 907, 989
alsinoides 488
Alsocomus 365
Alsodeia 644
alternans 181
Alternanthera... ... ... 160, 329
althæa 905
altirostris 115
Alysicarpus 318, 325, 689
amæna 483
amænum 182
amara 325
Amarantaceæ 159, 167, 329, 490, 578, 956
Amarantus 159, 160
Amaryllidaceæ 330
Amaryllideæ 580
amata 570
Amathusia 469
Amaurornis 310, 365
Amblycephalidæ 356, 843
Amblycephalus 90, 356, 546, 618, 843, 845
americana 579
ambrosioides 329
amherstiæ 309
Amherstiana 956
Ammannia 326, 335, 336
ammannioides 969
ammon 187, 208, 765, 980
amonyma 132
Ampelidaceæ 324
ampelina 119
amplexicaule 491
amplexicaulis 970
Amyoteinæ 335
anabasis 396
Anacardiaceæ ... 68, 69, 83, 84, 85, 86, 325, 477, 580, 947, 964
Anacardium 69, 675, 680
anadoxa 411, 412

PAGE
Anæctangium ... 939
anagallis ... 157
Anagallis ... 327
anambæ ... 883, 891, 892
ananda ... 30
Anaphœis ... 23
Anaphæis ... 570
anaplecta ... 598
Anas ... 217, 313, 922
Anatidæ ... 921
Anatinæ ... 312
anceps ... 588
anchorago ... 177, 333
Aneilema ... 331
Ancistrocerus ... 137
Ancistrodon ... 778, 1002
ancyrota ... 607
andamana ... 942
andamanensis ... 280, 789, 792
andamanicus ... 992, 993
anderesa ... 576
andersoni ... 302
Andrachne ... 492, 948
Andrena ... 129, 130, 131
Andromeda ... 485
andropogon ... 164, 165, 332
Androsace ... 486
Aneilema ... 318
Anemone ... 475
anglica ... 921
anguina ... 166
angulare ... 181
angulatum ... 329
angulosa ... 327
angustatus ... 941
angusticeps ... 884, 892
angustifolia ... 380, 487
angustifolium ... 499
angustifrons ... 388
Anisomeles ... 159, 329, 580
Ankali ... 580
annectens ... 117
annulatus ... 164
Anodendron ... 577
Anœctochilus ... 499
Anogeissus ... 75, 325
Anomura ... 232
Anona ... 167, 323, 943
Anonaceæ ... 30, 323, 658, 943
Anomobryum ... 940
Anorthura ... 904

PAGE
Anosia ... 46, 47
anotis ... 326, 968
Anser ... 312, 367, 921
Anseres ... 312
Anserinæ ... 312
antennifer ... 718
Antestia ... 177, 333
Anthistiria ... 332
Anthophila ... 129
Anthopogon ... 951
Anthracoceros ... 306, 363, 549
Anthus ... 142, 302, 362, 915
Anticrates ... 429
antidoxa ... 435
antidysenterica ... 57, 327, 486
antigone ... 261, 524
Antilope ... 197, 823
antiquorum ... 162, 696
Apatura.. 43, 638, 639, 646, 647, 648, 649, 667, 669, 671, 863
Aphnœus ... 568, 569
aphylla ... 169, 171, 385, 683
apiaster ... 917
apicicauda ... 308
Apines ... 177
Apium ... 166
Apluda ... 331
Apocynaceæ ... 72, 48, 57, 327, 384, 486, 575, 576, 577, 578, 654, 953
Aporosa ... 761
Appias ... 27, 570, 976
aprobola ... 602
aptera ... 485
apterus ... 552
apus ... 917
aquaticus ... 284
Aquifoliaceæ ... 477
aquilina ... 180, 332
arabica ... 64, 173, 326, 568, 972
Arabis ... 475
Araceæ ... 501
Arachnechthra ... 303, 362
Arachnida ... 232
Arachnothera ... 303
Arachnotherinæ ... 303
Aradus ... 1008
Aralia ... 483, 721
Araliaceæ ... 483, 721
arborea ... 69, 329, 580, 676, 959
arborescens ... 711
arboreum ... 70, 486, 701

PAGE
Arboricola ... 310, 365
Arbortristis ... 383
Archibuteo ... 523
Arctiadæ ... 437
arcuata ... 217
ardates ... 568
Ardea ... 217, 312, 365, 921
Ardeidæ ... 224, 312, 921
Ardeola ... 217, 312, 366
Ardetta ... 312, 366
Ardisia ... 952
Areca ... 576
arenarius ... 162
arenosa ... 582, 583
Argemone ... 323
argentauris ... 120
argentea ... 329, 159, 487, 490
argenteofacialis ... 510
argoonda ... 216
Argostemma ... 484, 967
arguta ... 950
argutum ... 182
Argya ... 114, 265
Argynnis ... 635, 644, 647, 652, 654
Argyreia ... 328
Argyrolobium ... 702
argyrophylla ... 481
Argyroploce .. 437, 587, 589, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606.
argyrotricha ... 485
Arhopala ... 569
ariadne ... 474, 645, 653
arietinum ... 166
arima ... 129
Arisæma ... 331
arissæma ... 501
aristata .. 143, 163, 374, 475
Aristida ... 164
Aristolochia ... 160, 579
Aristolochiaceæ ... 160, 579
aristolochiæ ... 32, 33, 569
Arjuna ... 74
arkal ... 208
armandii ... 123
armeniaca ... 480
arnensis ... 338, 532, 897
Aroidaceæ ... 162, 331
aromaticus ... 575

PAGE
Aroideæ ... 579
arquata ... 262, 920
arrhiza... ... 162, 331
Artamus ... 360, 361
artaxia ... 1015
artemidora ... 412, 415
artemisia ... 327, 485, 579
Arthraxon ... 331
Articolla ... 590, 591
articulata ... 67
artifica ... 411, 421
Artobatrys ... 323
Artocarpus ... 330
Aruncus ... 717
arundinaceæ ... 453
arundinaceum ... 163
Arundinax ... 360
Arundinella ... 331
arundo ... 332
arvalis ... 770
arvensis ... 302, 327, 488, 916, 965
Asarcornis ... 263, 313, 546
Asaphistis ... 590
Ascaris ... 837
Asclepediaceæ ... 57, 654
Asclepiadaceæ... 171, 327, 385, 386, 486
Asclepiadeæ ... 48, 53, 578, 581
Asclepias ... 48, 52
asiatica ... 216, 303, 305, 362, 386, 411, 413, 580
asiaticum ... 576
asiaticus ... 312, 911
Asio ... 917
Asionidæ ... 917
Asopinæ ... 335
Asparagus ... 161, 318, 331, 500, 581
asper ... 57
aspera ... 160, 329, 491, 578, 717, 967
asperifolia ... 380
asperrima ... 328
asperulus ... 484
Asphodelus ... 161
asphodelus ... 570
aspidias ... 599
Aspidieæ ... 181
Aspidium ... 181
Asplenieæ ... 181
Asplenium ... 181, 332
assimilis ... 116, 986
Astata ... 510, 511, 512
Aster ... 484

PAGE
Asteracantha ... 158, 328, 868, 869, 872, 876, 878
asterias 429
asteric 36
asterope 442, 461, 566
Astragalus ... 478, 711, 712, 713-715
astrosema 594
Astur 308, 364, 918
astuta 513
Asvath 865
Asystasia 318, 328
Atalantia 324
Atarmus 126
Atella ... 27, 566, 635, 638, 644, 646, 650, 1017
ater 122, 359, 904
athamas 567, 639, 648, 660
athertoni 305
Athyma ... 31, 637, 640, 646, 648, 652, 847, 848, 849, 854, 864
Athyrium 181
atlites 642, 651, 869
atra 546, 920
atricapilla 301, 361
atriceps 109, 144, 145, 903
atrigula 301, 361
atrigularis 910, 911
atrinuchalis 311, 365
Atriplex 160
atrisuperciliaris 111
atropurpurea 160, 478, 710
Atylosia 325, 479
Aucuparia 67
aulicus ... 87, 88, 90, 93, 95, 96, 98, 102, 103, 104, 105, 106, 284, 344, 546, 549, 557, 619, 756, 757, 770, 844, 898
aurantiaca 911, 991
Aurantium 68, 167
auratum 180
aurea 500
aureus 184, 518, 545, 939
auriceps 153, 916
auriculatum 181
aurifrons 120
aurita ... 217, 254, 255, 256, 261, 995
auriventer 884, 896
australis 494
avenacea 331
Averrhoa 80
Avicennia 159

PAGE
aviculare 491
axiana 1002
axillare... ... ... 579, 694, 701
axillaris 331
axis 206, 770
Azadirachta 82
Azanus 568
azedarach 82, 571
azurea 128, 361

Babax 112
babylonica 498
baccata 78
baccatta 143
bachelix 280, 284
bacillaris 482, 692
Bactra ... 582, 583, 584, 585, 586, 587
badius 308, 364, 996
Bæhmeria 373
bæri 313
Bagrada 177
bakkamæna 307, 364
baldus 460
Baliospermum... ... 579, 694, 701
balsamina 324, 476
Bambusa 332, 453
Bambusicola 309
banian 1008
barbadense 701
barbarum 157, 955
barbata 164, 319, 332, 501, 991
barbatulum 330
barbatus 284, 329, 918
Barbula 940
Barleria... ... 158, 328, 575, 872, 878
barlerioides 387
Barringtonia 69, 593
basilicum 159, 392
basilisca 412, 416
Bassia... 625
Bassini 728
Bassus 728, 729
Bauhinia 60, 325, 479, 480
baya 627, 632
baylei 752
beddomei 327
beema 915

PAGE

Begonia ... 320, 326, 483
Begoniaceæ ... 326, 483
begoniæfolia ... 69, 79
bela ... 457
belangeri ... 112, 358
belerica ... 74
belgaumensis ... 318, 325
bella ... 690
bellii ... 941
belonacma ... 412, 416
Belostoma ... 738
bengalensis ... 57, 161, 162, 330, 364, 495, 758, 865, 880, 881, 883, 888, 889, 890
bennetti ... 199, 209, 982
bennettiana ... 330
benthamiana ... 489
Berchemia ... 687
Berberidaceæ ... 374, 475
Berberis ... 143, 374, 475
Bergia ... 170, 323, 370, 969
bethami ... 441, 458
bethosia ... 644
betonica ... 328, 390
Betula ... 333
bevani ... 571
bhamœnsis ... 116
Bhringa ... 122
biaurita ... 332
Biblia ... 741
bicalyculata ... 158
bicarinata ... 728
bicincta ... 308
bicolor ... 880, 881, 884, 893, 894
bicornis ... 305, 363, 432
bicuspis ... 714
biddulphi ... 546, 549, 917
Bidens ... 327, 485
bidentata ... 491
biflora ... 393, 490
biflorus ... 163, 480, 718
bifolia ... 489
bifrenalis ... 775, 780
Bignoniaceæ ... 158
Bile ... 575
Bilimbi ... 80
biloreatus ... 775, 830, 845
bimaculata ... 916
binotatus ... 559
bipustulatus ... 138

PAGE

bisaltide ... 643, 653
bitorquatus ... 556
Bixaceæ ... 73, 74, 328
Bixineæ ... 577
blanda ... 941
blanfordi ... 208, 359, 360, 365
Blechneæ ... 180
Blechnum ... 180
Blepharis ... 158, 172, 328
blitum ... 159
Blumea ... 327
Blyxa ... 330
blythi ... 189, 208
bochus ... 568
Bochmeria ... 497, 697
Bœnninghausenia ... 477
Bœrhaavia ... 159, 329, 395, 490
bœticus ... 568
Boidæ ... 340, 610
bolina ... 567, 642, 653
Bombax ... 61, 476, 859, 862
bombayanud ... 887
Bombus ... 235
Bonnaya ... 328
Boraginaceæ ... 72, 73, 327, 487, 954
borealis ... 142
Bos ... 184, 185, 186, 208, 770
boscas ... 313, 922
Boselaphus ... 196
Bosia ... 956
Boswellia ... 81, 324, 570
Botia ... 546
Botrychium ... 183
bottanensis ... 526
Bougainvillea ... 159
boulboul ... 150
brachiata ... 160, 172
Brachiopoda ... 228
brachycarpa ... 168
brachydactyla ... 916
Brachymenium ... 536, 537, 940
Brachypodinæ ... 120
brachystachya ... 330
brachystachyum ... 695
brachyura ... 988
bracteata ... 160
brahvicus ... 944
braminus ... 609, 844
Brandrethiana ... 688
brandti ... 913
brasiliensis ... 331

PAGE
Brassica 166
brassicæ 269
brevirostris 125, 905, 913
brevispina 711
brevistigma 171
Breweria 172. 954
Bridelia 73, 330, 493
brodiei 307, 755, 918
brotali 614, 617, 837
Bronssonetia 495
Bruguieri 972
brunnea 111
brunneicephalus 262, 369
brunneipectus 365
brunoniana 485
Bryophylium 325
Bryozoa... 228
Bryum 537, 940, 941
bubalina 184
bubalinus 194, 545, 822
bubalus 186
Bubo 917
bubo 1007
Buboninæ 307
Bubulcus 217, 312, 366
buccata 770
Bucerotidæ 305
buchanana 578
Buchanani 55, 914
Buchananiana... 475
Buddleia 386, 487
Budorcas 195, 807, 809, 810, 812, 814, 815, 817, 818, 819, 820
Bufo 341, 612, 614, 622, 840
bulbifera 330
bulbosus 162
bungaroides 338, 355
Bungarus ... 87, 92, 93, 211, 296, 338, 355, 549. 621, 765, 770, 778, 787, 791, 832, 835, 838, 845, 897, 899
bungarus... 338, 355, 546, 841, 845, 897, 899
bupleuroides 490
Burhia 947
burmanica 126
burmanicus 121. 359
burmanni 323
burnesi 258
Bursa-pastoris 475
Burseraceæ 81, 324
burtoni... 913
Butastur 549
Butea 62, 479, 640
Butorides 312
buxifolia 70, 953
Buxus 396
Byblia ... 566, 636, 638, 645, 646, 653

cabanisi 303
cabocephalus 722
Caccabis 920
cachemirica 483, 721
cachinans 921
Cactaceæ 948
Cadaba 374
cælestis... 311, 425, 525, 546, 749, 921
cærulatus 752
cærulea... ... ...328, 333, 335, 336
cæruleicephala 910
cærulescens 549
cæruleus ...87, 93, 268, 296, 298, 338, 355, 549, 757, 765, 897, 918
Cæsalpinia 63, 479, 716
cæsia 662
Cajanus... ... ... 166, 708, 1007
Caladenia 571
calamus 501
Calandrella 916
calathisca 427
calcuttensis 941
calidris 920
Caligorgia 227
Callacanthis 913
Callambulyx 761
Callicarpa 328, 389
Callicebus 978
callichlora 603
callicratis 605
Callidryas 977
calliglauca 436
Calligonum 691
Calliope 259, 300, 910, 991
Calliphrusus 728
Callophis ... 266, 281, 356, 549, 618, 842, 548
callosus... ... ... 328, 868
Calluna 333
Calotes 352, 782, 783
Calotropis ... 48 52, 53, 171, 327, 385

PAGE
calvus ... 364
calycina ... 59, 324, 328, 968
calicinum ... 325
calycoptera ... 373
Calycopteris ... 325
Calymperes ... 940
camara ... 318, 320, 328, 388
cambayensis ... 919
camelorum ... 171, 689
Camena ... 30
camiba ... 639, 649, 667, 669, 863
Campanula ... 485
Campanulaceæ ... 327, 485, 577
campanulatum ... 951
campestris ... 166
Campophaga ... 126, 148, 360, 754
camprestis ... 869
Campteria ... 332
Campylopus ... 939
camtschatkensis ... 259, 300
canachodes ... 434
candicans ... 483
candolleana ... 326, 639, 675
candolleanus ... 712
canente ... 362
canescens ... 475, 483, 492, 691, 958
canicapillus ... 304
caniceps ... 912
canidia ... 269
canifrons ... 121
canis ... 225
Canis ... 518, 545
cannnabina ... 492, 566, 957
canabinum ... 382
Cannabis ... 494, 975
canorus ... 154, 306, 917, 989
Canscora ... 327
cantoris ... 345
cantorus ... 898
canum ... 159
Caotechis ... 211
capensis ... 311, 323, 325, 365, 577
capillaris ... 331
capillus ... 179, 332
capistrata ... 144, 145, 754, 908
capitalis ... 125
capitata ... 329, 395, 483
Capitonidæ ... 304
Cappa ... 950
Capparidaceæ ... 80, 167, 168, 374, 683
Capparis ... 169, 683

PAGE
Capra ... 184, 189, 190, 191, 208, 280, 770, 808
caprata ... 148, 299, 361, 907
capreæ ... 333
Capricornis ... 809, 810, 811, 812, 823
Capricornulus ... 810
Caprifoliaceæ ... 374, 378, 379, 380, 381, 382, 484
Caprimulgidæ ... 306
Caprimulgus ... 306, 363, 992, 993
Capsicum ... 157, 166
capsiformis ... 534, 535
capucinus ... 88
cara ... 302
Caragana ... 711
Carambola ... 80
carandas ... 318, 327, 384, 486
carbo ... 312, 365, 546, 921
Cardamine ... 323
Cardiospermum ... 581
Carduelis ... 912
cardui ... 34, 567, 642, 652
carenota ... 431
Careya ... 69, 676
Carica ... 167, 326
carica ... 330
caricosum ... 627
carimonensis ... 770
carinata 96, 266, 267, 549, 622, 770, 773, 832
carinatus ... 338
Carissa ... 318, 327, 384, 486
carneipes ... 990
carnosa ... 55, 489
caroli ... 130
carota ... 166
Carpodacus ... 301, 912
Carpophaga ... 308, 365
carteri ... 225, 226, 227, 233
Carum ... 326
caryactis ... 596
caryophyllacea ... 264
Caryophyllaceæ ... 323, 375, 475, 546, 965, 966
Caryopteris ... 389
Caryota ... 331
caryotideum ... 181
Casarca ... 313, 751
Casearia ... 326, 694
cashmirianus ... 184, 201
cashmiriensis ... 191, 208

PAGE
casiotis 142, 795, 919
Caspella 475
Cassia 63, 325, 479, 568, 570, 577, 715, 716
Cassiope 951
Castalius 30
castanea 144, 149
castaneiceps 117, 124
castaneicoronata 117
castetsi 644
Casuarina 317, 330
Casuarinaceæ 330
catappa 74, 579
catechu 65, 524, 576
catharacma 412, 415
Catharsius 273
cathena 132
Catochrysops 568
Catopsilia 570, 977
Catreus 156
caudata 41, 265, 443, 464, 465
caudatum 179
caudatus 811
caudolineatus 775
caulina 330
Cautlcœa 500
cavendishii 547
Cedrela 82, 83, 143, 324, 477
Cedrus 79, 498
ceilonensis 885
Celastraceæ 324
Celastrineæ 578, 946
Celastrus 324, 946
celinde 467, 469, 470, 473
Celosia 159, 329, 490
Celsia 157, 328
Celtideæ 576
Celtis 494, 669
Cemas 195, 545, 810, 811
cenchroides 163
Cenchrus 163
Centratherum 326
Centropus 307, 364
Cocos 162
cepa 161, 166
cephalophus 209
Cephalostigma 327
cephalotes 159
cerastiodes 475
cerata 587
ceratoides 956
Ceratophyllaceæ 161, 330

PAGE
Ceratophyllum 161, 330
Ceratopteris 180
Cercopithecus 978
ceriodes 607
cernuum 375
Ceropegia 50
Certhia 904
Certhidæ 122, 904
cervicapra 197
Cervulus 184, 200, 209, 549, 758, 842
Cervus 184, 201, 202, 203-207, 209, 253, 747, 770,
Ceryle 305
Cethosia 635, 636, 638, 643, 653
ceylonensis 127, 144, 148, 361
ceylonica 442, 462, 882, 885, 886, 1017
ceylonicus 87, 355, 778, 885
Ceyx 305, 363, 749
Chakrani 579
chalcocrossa 424
Chalcoparia 120, 362
Chalcophaps 309, 365
Chamaita 437
champaca 323
Chara 285, 762, 763
charadræa 594
Charadriidæ 311, 920
Charadrius 311
charantia 166
Charaxes 31, 42, 43, 270, 271, 567, 635, 638, 639, 646, 647, 648, 650, 654, 658, 659, 660, 665, 667
chebula 74, 325, 579
checla 308, 364, 755
Cheilanthes 179
Cheilanthus 332
Chelidon, 152, 914
Chelidorhynx 128
Chenopodiaceæ 160, 329, 395, 396, 491, 956, 957
Chenopodium 329, 491
cheopis 234
cheritra 30
chersydrus 281
Chettusia 258, 920
chiasta 421
Chibia 122, 522
chicquera 919
Chilades 34, 567
Chimarrhornis 149, 299, 909
chinense 329, 694

PAGE
chinensis 109, 164, 310
chinquis 309
chionardis 423, 424
chiquera 999
chirata 487
Chirita 489
Chloris 164, 332
Chlorities 229
chlorocephala 120
chlorolophus 303
Chlorophytum 331
Chloropsis 120
chloropus 310, 365, 920
chlorostachys 712
Chloroxylon 580
Chromis 761
Chrosis... 587
Chrozophora 161
chrysæa 116
chrysaëtus 997
chrysæus 300
chrysippus ... 40, 41, 44, 45, 47, 48, 50, 52, 566, 567, 635, 643
Chrysocolaptes 304, 362
Chrysolophus 309
Chrysomelidæ 333
Chrysomelides 233
Chrysopelea 758, 779, 782, 899
Chrysophlegma 303
chrysopygia 908
chrysorrhœum... 303
chucar 920
Cicada 772
Cicadatraria 773
Cicadidæ 772
Cicer 166
cicerifolius 713
Cicindela 1008, 1009
Ciconiidæ 312
ciconium 974
cicutarium 181
ciliaris 164, 331
ciliata 329, 498
cilitaa 332
Cimex 335
Cimicidæ ... 177, 333, 334, 335, 336, 571
Cimicinæ 333, 335
ciuclorhynca 910
cinclorhyncha 151
Cinclus 911
cineraceus 122, 126, 359

PAGE
cinerascens 949
cinerea ... 217, 312, 326, 365, 716, 921
cinereoventer 269
cinerens 311, 609
cinnamomea 312, 366
cinnamomeiventris 122
cinnamomeus ... 115, 116, 120, 302, 913, 986, 987
Cinnamomum 75
circia 313, 922
Circus 308, 364, 918
Cirripedia 230
Cirrochroa 636, 644, 651
Cissa 109
Cisticola 360
citharistis 428, 595
citreola... ... ... 915, 302, 1019
citreolades 1019
citreoloides 915
citrina 300
Citrullus 166
Citrus 68, 167, 945
Cittocincla 300, 361
clarkeana 971
clarkei 61
clavata 496, 697
claviculata 600
Clematis 143, 328, 475, 575, 576
Cleome 168
Clerodendron 159, 391, 392, 528, 575
Clerome 468, 469
clydonias 437
clypeata 313, 546, 922
cnejus 568
coagulans 955, 962
cobbe 319, 325
Coccidæ 24, 761
coccinea 324, 371, 968
coccineum 170
Coccothraustes 911
Cocculus 67, 168
Coccystes 265, 306, 363
cochleata 181
Cocos 167, 578
coctaei 96
Cœca 1002
Cœlenterata 226
cœlicolor 991
Cœlogyne 499
Cœnocoris 333

Page
Coffea ... 326
Coix ... 331
Colebrookia ... 329, 390
colebrookiana ... 86, 497
Coletis ... 570, 571
Coleus ... 329, 575
collaris ... 340, 528, 757, 1005, 1007
Collembolen ... 234
Collenbolenden ... 234
collinum ... 973
collurioides ... 125
Colocasia ... 162
colonum ... 163, 331
colorata ... 485
colotis ... 270
Colpura ... 234
Coluber ... 268, 281, 345, 346, 347, 353, 549, 756, 758, 825, 827, 844, 898
Colubridæ ... 311, 340, 611, 756, 757, 897
Columba ... 309, 795, 919
Columbæ ... 308
Columbidæ ... 919
columella ... 641, 859, 860, 862
colurna ... 143, 498, 693
Colutea ... 711
Combretaceæ ... 74, 75, 325, 579
Commelina ... 162, 331, 501
Commelinaceæ ... 162, 331, 501
commixtus ... 109, 110
communis ... 161, 166, 310, 325, 328, 391, 920, 960, 962
Comocritis ... 422, 423
compactum ... 383, 486
Compositæ ... 167, 175, 326, 382, 484, 579, 949, 950, 962
compta ... 510
concanense ... 326
concinna ... 110, 177, 855
concinnum ... 708
concinnus ... 501
concolor ... 120, 303
condinarus ... 549
condurensis ... 770
conglomeratus ... 162
conicus ... 338, 1000
Coniferæ ... 78, 79, 498, 960
Conneraceæ ... 567
Connochœtes ... 814
consanguinea ... 940
consimilis ... 639, 649, 669

Page
contortus ... 332
contra ... 935
Convolvulaceæ ... 167, 328, 488, 954
Convolvulus ... 172, 488
Conyza ... 327
conyzoides ... 326
Copepoda ... 232
copidotis ... 584
Copsychus ... 300, 361
coracana ... 165
Coraciadæ ... 305, 916
Coracias ... 305, 363, 916
coraifolia ... 489
corax ... 144
Corchorus ... 859
cordata ... 966
Cordia ... 72, 487
cordifolia 168, 326, 332, 484, 492, 575, 693, 948
core ... 44, 45, 46, 48, 49, 55, 56, 58, 566
coreta ... 44, 45, 48, 55, 56, 58
Corethra ... 740
coriaceum ... 379
Coriaria ... 375, 478
Coriariaceæ ... 375, 478
Corixa ... 732, 737
Cornaceæ ... 79, 378, 483
corniculata ... 324, 476
Cornus ... 69, 143, 378, 483
cornuti ... 48
coromandeliana ... 157, 328
coromandelianus 217, 263, 264, 284, 313
coromandelica ... 216, 310
coromandus, 217, 306, 312, 358, 359, 363, 366
coronans ... 182
coronaria ... 384
coronarium ... 330
coronatum ... 940
coronarius ... 376
coronatus ... 124
Coronella ... 556
corrone ... 144
corthyntis ... 596
Corvidæ ... 108, 258, 902
Corvus 108, 144, 219, 256, 257, 358, 522, 545, 755, 902
Corylus ... 143, 498, 693
corymbosa ... 48, 169, 326, 376, 966, 967
corymbosus ... 332
Corypha ... 284

PAGE

Cosmopterygidæ 410
Cosmopteryx, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421
Costus 578
Cotile 302, 362, 914
cotinifolium 378, 484
cotinus 477, 947
Cotoneaster 482, 692
Coturnix 216, 310, 920
Cranitome 490
Crassulaceæ 325, 482
cratægoides 71, 486
Cratægus ... 60, 61, 482, 691
Cratæva 80
Crateropodidæ 903, 904
Crateropodinæ... 111
crecca 313, 546, 922
crenata 182, 320, 326
crenulata 482, 691
crenulatus 772, 939
Crepis 485
crepuscula 978
Cressa 171, 954
cretica 170, 171, 180, 954, 972
Cribellates 233
Crinum 330, 576, 580
crispa... 950
crispum 139
crispus 810
cristata 158, 325, 331, 499, 916
cristatum 327
cristatus ... 125, 216, 218, 308, 360, 905
crocale 570
Croce 1005, 1007
Crocopus 308, 365
Crotolaria ... 46, 50, 55, 173, 320, 325, 478, 577, 688, 689, 947
crotolariodes... 475
crotalotis 432
cruciata 177
Cruciferæ ... 177, 323, 475, 943, 944
cruentatum 362
cruentatus 351, 791
crus-galli 162, 165
Crustacea 230, 231
Crypsirhina 358
Cryptinæ 729
Cryptolepis 55, 578
Cryptolopha 124, 147

PAGE

Ctenopelmini 726
Cuculidæ 917
Cuculinæ 306
cucullata 303
cuculoides 307, 364
Cuculus ... 154, 155, 306, 363, 754, 917, 989
Cucumis 166, 326
Cucurbita 166
Cucurbitaceæ ... 167, 326, 483
Cufa 636
Culicicapa 127, 144, 148, 361
Culicidæ 234, 732, 733, 739
cultricornis 232
Cuminum 578, 579
Cuneopsis 229
cunia 496
cunyome 637
Cupha ... 636, 638, 644, 646, 650, 651, 879
Cupuliferæ 498, 698
curassavica 52
curcas 493, 693, 701
Curculiga 330
Curculionides 234
Curetis 30, 569
curocana 332
cursitans 360
Cuscuta 488
cuspidata 484, 950
Cyamopsis 165
cyane 636, 643, 644
cyanea 336
Cyanecula 300, 910
cyanellum 96
cyaneus 353, 789, 918
Cyanistes 903
cyaniventris 117
Cyanops 305
cyanoptera 362
Cyanotis 331, 501
cyanura 598
cyanuroptera 118, 119
cyanus 300, 910
Cyathula 395, 491
Cyclea 323
cycloceros 208
cyclopæa 412, 413
Cyclostrema 229
Cyclostrematidæ 229
cyclurus 348, 897

PAGE
Cydonia 691
Cygnus 262, 263
cylindrica 939
Cylista 325, 859
cymbaria 332
cymbifolium 940
cymineuta 424
cyminum 578, 579
cymosum 491
Cynanchum 385, 487
Cynodon 164, 332
cynodon 538, 353, 332, 845, 897, 899
Cynoglossum 327, 488
Cynopterus 281
Cynthia 654
Cynthis 653
Cyon 273
Cyornis 127, 259, 361
Cyperaceæ 162, 167, 331
Cyperus 162, 331
Cyphanza 723
Cypselidæ 306, 917
Cypselus ... 142, 154, 363, 754, 917
Cyrestis ... 43, 636, 641, 646, 647, 648, 649, 862, 865
Cyrtomium 181
Cystopteris 179

dabryi 303
dactylon 164, 332
Dædalacanthus 387
Dæmia 171
Dafila 313, 546, 750, 922
dahuricus 688
daksha 32, 37
Dalbergia 62, 325, 641, 859
Dalbergiæ 862
dalbergioides 62, 479
dalhousiæ 487
Dalhousianus 388, 489
dalzellii 324, 325
danæ 270, 571
Danainæ 24, 32, 33, 39, 40, 44, 45, 49, 566
Danais 21, 40, 41, 44, 45, 46, 47, 48, 49, 50, 51. 52, 53, 54, 55, 56, 566, 567, 635, 643
davisoni 290, 291
Daphne... ... ... 145, 492, 957

PAGE
dasycarpum 954
Datura 157, 328, 489
Daucus 166
dauma 151, 300, 754
davisoni 124, 359
Davallieæ 179
dealbata 882, 887
dealbatus 880, 887
Debregeasia 330, 497, 698
decorata 591
decumana 68, 167
decussata 327
Deguminosæ 704
Delias 23, 570, 976
delphinifolia 318, 328
Delphinium 475
deltoides 500
demersum 161, 330
demoleus 569
Dendrelaphis ... 347, 549, 775, 776, 779, 780, 781, 782, 783, 788, 790, 827. 830
Dendrobium 330, 499
Dendrocitta 109, 358, 752
Dendrocycna 313, 366
Dendrocygna 217
Dendrocopii 153
Dendrocopus ... 153, 303, 304, 362, 916
Dendrelaphis 757
Dendrophis ... 281, 347, 546, 775, 776, 777, 779, 780, 781, 782, 783, 784, 787, 788, 790, 791, 827, 828, 829, 844, 845, 898
denticulatum 327
denundatum 475
Deodara 79, 498
Dermaptera 235
Derris 577
Desmodium 325, 479, 689, 706, 707, 708
Deutzia... ... ... 376, 482
diademata 119
diardi 609, 757. 770 844, 897
Dicæidæ 303
Dicæum 303, 363
dicellias 410
Dichoceros 305, 363
dichotoma 158, 162
dichotomum 163
Dichrocephala 326, 484
Dichrostachys 716
dicica 971

PAGE
Dicliptera ... 328, 490
Dicruridæ ... 122, 904
Dicrurus ... 122, 359, 549, 904
Dieuches ... 234
difformis ... 331
diffusa ... 158, 159, 327, 329
dilata ... 143
dilatata ... 143
dilleniæfolia ... 68
Dillenii... ... 948
Dimeria ... 331
dimorpha ... 606
Dindymus ... 333
Dineutes ... 735
Dinodon ... 344, 618, 621, 844
dioica ... 169, 945
Dioscorea ... 330, 500
Dioscoreaceæ ... 330, 500
Diospyros .. 71, 319, 327, 639, 675, 682
diphylla ... 325, 331, 642
Diplaxium ... 181
Diploptera ... 136
Dipsaceæ ... 484
Dipsacus ... 484
Dipsadomorphinæ ... 831
Dipsadomorphus 267, 268, 338, 352, 353, 757, 758, 789, 791, 831, 833, 845, 897, 899
Diptera ... 737, 739, 740
Dipterygium ... 944
dipyrena ... 143, 477
Discophora 35, 42, 43, 464, 467, 468, 469, 470, 473, 474, 646
diserta ... 593
dispermum ... 486
Displazium ... 181
Dissemurus ... 122, 360
dissimilis ... 96, 104
Dissura... .. 312
Distantella ... 729
distants ... 182
distichum ... 163
divergens ... 331
diversifolia ... 482, 483
dixon ... 300
Dodonæa ... 956
Dœmia ... 486
dolabriformis ... 862
Doleschallia ... 42, 643, 653
Dolichos ... 166
PAGE
domesticus ... 301, 361, 913
Dophla... 43, 635, 638, 639, 647, 649, 650, 654, 672, 675, 676, 677, 679, 680, 681
dorsalis... ... 556, 563, 831, 845
dorippus ... 44, 52, 643
dorsolateralis ... 898, 899
Dosua ... 710
dubia ... 920
dubium ... 556, 559
Ducula ... 309
dulcamara ... 954, 962
dulce ... 66
dumetorum ... 144, 146, 326, 370
dussumieri ... 216, 281
Duthiei ... 75
duvauceli ... 202
Draco ... 281
Dregea ... 53
druidica ... 428
Drymaria ... 966
Drymocataphus ... 115, 116
Drymochares ... 117
Drynaria ... 182, 332
Dryocalami ... 297
Dryocalamus ... 287, 290
Dryonastes ... 111, 112, 752
Dryophis ... 338, 353, 354, 757, 777, 780, 781, 782, 789, 834, 835, 845, 899
Dryopithecus ... 279
drypetis ... 440, 451, 454, 465
Dyakia ... 229
Dysophylla ... 318, 329
Dytiscid ... 734, 737, 740
Dytiscidæ ... 734, 737, 740
Dytiscus ... 734, 737, 740

earlii ... 114
Ebenaceæ ... 71, 327, 682
Ebenus ... 704
ebulus ... 374
eburnea ... 64, 171
Ecclinops ... 724
echerius ... 38, 474
echinatus ... 171, 331
Echinoderma ... 227
Echinops ... 171, 485
echinosperma ... 330

PAGE
Echis ... 266, 267, 338, 549, 770, 773, 832
Eclipta ... 485
Echmia ... 422
ecœlestinum ... 328
Eczetesis ... 726
edentulum ... 939
edgeworthii ... 327, 687
edwardsi ... 217, 218
egertoni ... 118
Ehretia ... 72, 73, 488. 954
Eichwaldi ... 954
Elachista ... 410
Elachistidæ ... 410
Elæagnaceæ ... 76, 329, 580, 958
Elæagnus ... 76, 329, 580, 958
Elæocarpus ... 324, 862
Elanus ... 918
Elaphodus ... 209
Elapinæ ... 835
elastica ... 495
Elatinaceæ ... 323
Elatineæ ... 370, 969
Elatostemma ... 969, 972
eldi ... 204, 209
elegans ... 309, 328, 394, 395, 397, 498, 699, 705
elengi ... 70, 327, 576
Eleocharis ... 162
eleoides ... 957
Eleosine ... 332
elephantum ... 81, 167
Eleusine ... 164, 165
Elionurus ... 164
eliptica ... 183
ellenriederi ... 177
ellioti ... 280, 533, 557
elliptica ... 328, 487
ellipticus ... 480, 718
Ellobius ... 280, 770
elodeoides ... 476
elongata ... 325
elphinstonii ... 887, 888
Elsholtzia ... 396, 490
elucura ... 519
Elymnias 41, 438, 443, 444, 445, 446, 464, 465
Elymniinæ ... 22
emblica ... 492
Embelia ... 327, 494, 580, 952
Emberiza ... 144, 522, 913, 914

PAGE
Emberizinæ ... 151, 362
Embiidæ ... 1009
emblica ... 330, 579
emeria ... 121, 359, 531
Emodi ... 383, 970
Enarmonia ... 592
enclitica ... 430
Engelhardtia ... 86, 497
Enhydrina ... 284
enhydris ... 831, 845
Enonymus ... 375
Enoplotrupes ... 234
Entomostraca ... 231
Ephemera ... 732, 733, 741
Ephemeridæ ... 738, 739
ephippias ... 587
Epibactra ... 582, 583
Epiblema ... 607
Epilobium ... 483
episcopus ... 312
epops ... 917
equinus ... 209
equisethifolia ... 330
equisetifolia ... 317
Equus ... 731
Eragrostis ... 164
erecta ... 485
erectus ... 276
eremita ... 902
erethista ... 411, 413
Ergolis ... 43, 636, 638, 645, 646, 653
Ericaceæ ... 70, 485, 951
ericoides ... 169
eriocarpa ... 705
Erinocarpus ... 324
Eriocaulaceæ ... 331
Eriocaulon ... 318, 331
eriocephalus ... 318, 319, 329
erioptera ... 169
erippus ... 46
Eriscrania ... 436
Erismatura ... 264, 284
Eristocophis ... 293
Erodium ... 974, 975
erotus ... 761
Erpodium ... 941
Erthesina ... 571, 572, 573
Erythrina ... 62, 325, 479, 580
erythrinus ... 301, 912
Erythrocebus ... 978
erythrocephala ... 991

PAGE
erythrocephalum 752
erythrocephalus ... 110, 306, 363
erythrogaster 514, 516, 555, 909, 1000, 1001
erythrogastra 151, 910
erythronota 909
erythronotus 144, 147, 905
erythropterus 144, 145
erythrorhynchus ... 3, 216
erythrorhachis 555, 923
Erythrospiza 912
Eryx 338, 549, 1000, 1020
Esacus 311
esculentum 157, 166, 171
esculentus 166
Ethmiadæ 422
etrida 270, 281, 571
Eublapharis 284
eucharis 23, 570
Eucosma 592, 607
Eucosmidæ 582
Eudynamis 307, 364
Eugenia 319, 326, 578
Eulabes 126, 360
Eulabetidæ 126
Eulamellibranchs 226, 228
Eulapis 638
Eulbepharis 770
Eulepis ... 635, 639, 646, 648, 657, 660, 663, 879
Eulophia 330
Euonymus 370
Eupatorium 382, 481
Euphorbia ... 160, 161, 318, 329, 330, 333, 396, 492, 695, 696, 765, 959, 970, 971
Euphorbiaceæ...73, 77, 160, 167, 329, 396, 492, 571, 577, 578, 579, 693, 695, 696, 697, 761, 851, 948, 959, 962, 970-1
Euplœa ... 41, 44, 45, 46, 47, 48, 49, 50, 55, 56, 57, 58, 271, 566
Eupodotis 217, 218
Euripus... 637, 638, 639, 649, 669, 671, 672
europa 440, 451
europæum 955
Eurotia 956
Eurydema 177
eurynome ... 567, 641, 649, 854, 856, 860, 861, 862, 879
Euthalia ... 43, 567, 638, 646, 639, 640, 647, 648, 649, 650, 675, 676, 678, 679, 680, 682, 879
Euthaliæ 679, 680
Euthalias 654
eutolmus 308
evelina 675
Evodia 324
Evolvulus 488
Exacum 327, 487
excelsa 78, 81, 143
excelsum 370
exotica 80, 324, 963
Exostoma 546
exserta 640, 849
extensa... ... ... 171, 486
exustus... 216
Eyolis 474

fabius 270, 271, 639. 648, 658
fabroniacea 941
Fagonia 170, 972
Fagopyrum 491
falcatum 181
Falco 142, 755, 919
falconeri ... 191, 208, 280, 711, 808
Falconidæ 918
Falconinæ 308
fallax 587
farinosa 179, 332, 374
Farnesiana 64
faro 761
Farsetia 168, 943, 944
fasciata 840
fasciatus ... 211, 216, 307, 338, 355, 364, 560, 791, 832, 835, 845, 899, 990
fascicularis 770
fasciculata 331
Fasciculi 225
fasciolatus 284, 897
fastigiata 951
fastuosa 157, 328
fausta 270
fea 209
febrifuga 319, 324
Febrifuges 574
feddeni 304
Felis 4-15, 545
fergusonii 291
Feronia... ... ... 81, 167

PAGE
ferozeporensis 131, 133
ferrago 155, 919
ferrea 144, 149, 299
ferea 580
ferruginea 127, 163, 770
ferrugineus 274, 309, 365
ferus 312
fibrata 597
Ficus ... 57, 58, 161, 319, 330, 373, 495, 496, 641, 697, 701, 865
Ficoideæ 326, 483, 969
Filices 179, 332
filiforme 940
filiformis 499
filipennis 1005-7
filipes 325
filix-mas 181
Fimbristylis 162, 163, 331
Fintona 726
firmus 770
Fissidens 939
Fistula 63, 325, 577
flaccidum 702
flacida 763
Flacourtia 73, 319, 323, 644
flammaxilliaris 362
flammea 549
flavala 120
flaveolus 362
flavescens 121, 834
flavicollis 116, 120
flavidiventris 301
flavinucha 303
flaviventris 125, 359, 360
flavolivacea 124
Flemingia 479, 859
flexuosum 183
floribunda ... 143, 325, 326, 377, 482, 580, 687
floribundum 323, 706
Fluggea 161, 330
Flueggia 959
fœderata 582
fœtens ... 143, 146, 150, 152, 379, 992
fœtida ... 160, 324, 485, 859, 957
foliolosa 67, 482
foliolosum 475
fontanum 181
foociscutis 137
Fordii 940
formosa 382
formosum 525, 526, 546
forsteni 338, 757, 897
foveolata 496
foveolatus 164
Fragaria 325, 481
fragrans 320, 325
Francolinus 216, 310
Franklinia 123, 360
franklini 305
Franklnia 360
fratensis 893
fratercula 116, 118
fraterculus 360
fraxinea 183
Fraxinus 143, 177, 397
frenatus 96, 345
fretensis 884, 892
Fringilla 913
Fringillauda 913
Fringillidæ 151, 911
Fringillinæ 301
frondosa 62, 479, 640, 849
frontalis ... 122, 208, 300, 909, 991
frontícinctus 338, 353, 354, 355
frugilegus 902
frugilens 257
frumentaceum 163, 165
frutescens ... 56, 57, 157, 166, 698
fruticosa 160, 172, 719, 957
fruticosus 143, 718
fucata 913
Fulica 546, 923
fulicata 783
fuliginosus 300, 910
fullo 571, 572, 573
fulvescens 911
fulvus 311
Funaria 940, 941
funiculata 164
furcatum 488
fusca 569
fuscata 123
fuscatus 123
fuscicapillus 280
fuscicollis 365
fuscipennis 517
fuscum 342, 343
fuscus 126, 360
fusiformis 227
futteyporensis 684
fytchii 309

PAGE
gabina ... 588
Gæaninæ ... 772
gaika ... 568
Gaillonia ... 373
Galerita ... 916
Galinsoga ... 485
Galium ... 484
gallica ... 944
Gallicrex ... 365
Gallinago 311, 365, 525, 546, 749, 921
Gallinula ... 310, 365, 920
gallinula ... 921
Galloperdix ... 216, 546
Gallus ... 216, 309, 365
gangeticum ... 689
gangeticus ... 159, 228
garcini ... 170
Gardenia ... 580
Gardneria ... 487
garrula ... 916
Garrulax ... 112, 358, 359
Garrulus ... 109, 150, 902
garuda ... 640, 649, 678
Garuga ... 324
garzetta ... 217, 366, 921
Gaultheria ... 950
gaurus ... 184, 770
gaussi ... 232
Gaviæ ... 311
Gavialis ... 228
Gazella ... 199. 200, 209, 521, 982
Gecinulus ... 303
Gecinus ... 144, 152, 153, 303, 362, 916
Geckonidæ ... 783
Geissaspis ... 325
generosa ... 594
Gennæus ... 309, 796
Gensia ... 723
Gentiana ... 487
Gentianaceæ ... 327, 487
genutia ... 49
Geocichla ... 300
Geotrupes ... 234
Geraniaceæ 80, 324, 476, 969, 970, 973, 974, 975
Geranium ... 476, 973, 974
Gerardiana ... 78, 705, 709
Gerbera ... 485
Gerbillus ... 978
germanica ... 945
Gerris ... 735

PAGE
Gesneraceæ ... 489
geto ... 546
Ghatense ... 941
gibbosa ... 495
gibsoni ... 329
gigantea ... 48, 52, 327, 385, 881, 882, 883, 890, 891
giganteum ... 328, 500
giganteus ... 890
Girardinia ... 320, 330, 496, 577
githaginea ... 912
giu ... 155, 307, 917
glaberrima ... 327
glabra ... 63, 325, 862
glabrescens ... 331
glabrum ... 160, 329
glaciale ... 961
glareola ... 920
glauca ... 331, 380
glaucescens ... 950
Glaucidium ... 307, 364, 755, 918
Glauconiidæ ... 609
glaucum ... 385, 537, 944
Glessula ... 228
glomerata ... 57, 330, 496
Gloriosa ... 500
Glochidion ... 330, 851
glutinosus ... 281, 388
Glycosmis ... 324, 963
Glycyrrhiza ... 333
Glyphipteryx. 429, 430, 431, 432, 433, 434, 435
Gmelina ... 580
Gnaphalium ... 484
gokhala ... 441, 445, 457
gokool ... 338, 831, 845
gondera ... 216
Goniophlebium ... 182
Goniopteris ... 182
goral ... 195, 545
gorei ... 775, 829, 842, 844
gossypifolia ... 1016
Gossypium ... 166, 700, 701
gouriana ... 323, 576
govaniana ... 490
govinda ... 308, 364, 918, 985
Gracilea ... 164
graciliflora ... 490
gracilis ... 117, 123, 290, 318, 360
Graculipica ... 126
Graculus ... 902

PAGE
Gralliæ 310
Gramen 627
Gramiaceæ 331
Graminaceæ 163
Graminæ 167, 175, 269
Gramineæ 654
gramineus 269, 284, 357, 757, 758, 770, 843, 845, 900
Grammitideæ 183
granatum 167, 378
Grandala 991
grandiflora 327
grandiflorum 397, 973
grandis ... 126, 325, 328, 577, 912
grandoculis 775, 780
grantia 303
granularis 331
granulatus 281
Graptophyllum 391
Graucalus 126, 360
graveolens 166, 170, 326, 693, 694, 712
gravivox 115
grayi 217, 312, 366, 794
gregaria 920
Grevillea 317
Grewia 170, 324, 476, 639, 662, 685, 859, 862
grewioides 692
griseicapilla 309
griseus 218, 280, 366, 552, 811
grisola 906
Grona 325
Grossularia 960
grossus 163
grunoniens 208
Grus 261, 310, 369, 524
Gryllotalpa 738
guentheri 281, 343, 549
Guizotia 166
gujaraticus 516
Gulbodla 59
gulgula... 362
gurial 305, 363
guttata 499
guttaticollis 110
gutticristatus 304, 362
Guttiferæ 323, 580
gutturalis 302
guyava 166
Gymnema 327
Gymnosporia 324, 946

PAGE
Gymnandropsis 169
Gynura... 327
Gypætus 284, 918
Gypsophila 375, 475
gyrans 708
Gyrinidæ 735, 737
Gyrinus 735
gyrotis 604

Habenaria 318, 330, 499
hæmatocephala ... 305, 363, 755
Hæmodoraceæ... 500
halantha 601
Halcyon 260, 281, 305, 363
Halenia 487
Haliætus 308, 918
haliætus 364
Haliastur 308, 364
halicacabum 581
Halictus 129
Halopyrum 164
Halorites 229
Haloxylon 160, 395, 396
Haltica 333, 334, 335, 336
Halyini... 571
Hamamelidaceæ 693
hamata 717
hamifera 411, 420
Hamiltonia 326, 371
Hamiltonii 943
Hamiltoniana 684
Hamiltonianus 370
Haminœa 229
hampsoni 641, 649
Haplanthus 228
haplonotus 989
haringtoni 313
Harpactes 306, 363
haspan 162
hastata... ... ... 699, 959
hastatus 492
Hebomoia 977
hecabe 567, 570
hebepetala 710
hector 32, 33, 569
Hedera... 483
Hedychium 330
Hedyotis 967

PAGE
hedysarifolia ... 575, 576
hegesippus ... 44, 50
helena ... 756
Helicteres ... 684, 701, 859
heliophilus ... 515
Heliotropium ... 173, 954
helix ... 483
Hemecercus ... 362
Hemichelidon ... 127, 148, 906
Hemidactylus ... 96
Hemidesmus ... 57, 581
Hemilepisters ... 772
hemionus ... 731
hemipempta ... 429
Hemiptera 177, 333, 336, 549, 571, 733, 752, 770
Hemipterorum ... 333
hemiptilopus ... 523
Hemipus ... 125
Hemitragus ... 192, 193, 194, 545, 808
Hemixus ... 120, 121
hemorhædus ... 545
hendecaphylla ... 325
Henicocephali ... 234
Henicurus ... 299, 908
Heracleum ... 326, 483
herbaceum ... 166, 700
herberti ... 555
herbisera ... 603
Herbivocula ... 123
herbosa ... 600
hermatodes ... 426
Herminium ... 499
Herodias ... 217, 218, 365, 366, 921
Herpestes ... 280, 283
Herpornis ... 120
Hesperidæ ... 21, 26, 38, 39
Hesperiidæ ... 564, 571
Hestia ... 39, 45, 46, 47, 48
heterantha ... 143
heterocarpa ... 158
Heterocera ... 17, 761
Heterocyathus ... 226, 228
heterophylla ... 326, 382, 496
Heteropsammia ... 226, 228
heterotrichia ... 132
hexagonotus ... 352, 353, 758, 791
hexandra ... 71
hexastichon ... 164, 165
heyneana ... 326, 329

PAGE
heyneanus ... 328
Hibiscus ... 166, 693, 700, 862
Hierococcyx ... 306, 363
Hieroglyphus ... 1008
Hierætus ... 918
hierta ... 567, 642, 651, 869, 874
hilaris ... 177
hilarodes ... 430
Hilarographa ... 425, 426, 427, 428, 429, 431
himalayana ... 477, 904
himalayanus ... 281, 341, 614, 618, 757, 791, 844, 1002
himalayensis ... 109, 153, 223, 916, 920
himalensis ... 479, 489
Hippophæ ... 958
Hiptage ... 318, 324
hircus ... 189, 208
hircina ... 702
hirsuta ... 318, 325, 333
hirta ... 966, 969
hirticeps ... 722
hirtus ... 693, 700
Hirundinidæ ... 257, 302, 914
Hirundo ... 152, 302, 362, 549, 914
Hislopia ... 228
hispaniolensis ... 913
hispida ... 58, 373, 379, 576, 967
histrionica ... 177
Hitchenia ... 330
hodgsoni ... 184, 187, 198, 208, 302, 915, 980
hohenackeri ... 330
hœmorrhoidalis ... 235
Holarrhena ... 57, 327, 486
Holmskioldia ... 389
holophracta ... 411, 414
Holoptelea ... 577
holti ... 120
Homalopsinæ ... 831
Homalopsis ... 770
Homo ... 150
Homoptera ... 772
honesta ... 585
honorata ... 307, 364
hookeri ... 328, 329
Hoplopterus ... 311
Hordeum ... 164, 165
hordonia ... 637, 640, 649, 654, 852, 854, 855, 856, 857, 858

PAGE
Horeites 124
Horornis 144, 147
horrida 169
horsfieldi 309
horsfieldii 643, 653
hortense... 391
hortensis 76, 158
hospes 512
hottentotta 122, 522
Hoya 53, 327
huebneri 442, 461
humbertianus 136
humeralis 893, 894
humiæ 546
hümei 545
humii 142, 905, 911
humile 486, 965
humilis 364, 476
humulis... 952
Huphina 570, 976
hurrianæ 978
hyalitis 599
hybrida 921
hydaspidis 393
Hydnocarpus 577, 644
Hydra 233
Hydrilla 161, 762
Hydrocampa 734
Hydrocharitaceæ 161
Hydrocharitaceœ 330
Hydrochelidon 921
Hydrocotyle 580
Hydrophobus 287
hygrometrica 940, 941
Hygrophila 328, 878
Hygrorhiza 163
hylocrius 193
Hymenodictyon 370
Hymenoptera 510, 549, 770
hymenostephana 373
Hymenostomum 939
hyneana 330
Hyophila 939
Hypacanthis 152
hyperbius 644, 652, 879
hyperboreus 921
Hypericaceæ 575, 476
hypericifolia 161, 970
Hypericum 375, 476
hyperythrus 153
Hyphæne 282
hypnale... 778
hypoleuca 497, 698
hypoleucum 484
hypoleucus 311, 920
Hypolimnas ... 21, 31, 567, 635, 638, 642, 643, 646, 647, 653, 654
Hypopicus 153
Hypotænidia 310, 365
Hypothymis 128, 361
hypoxanthum 128
Hypoxideæ 500
Hypoxis 500
Hypsipetes 120, 145, 904
Hypsirhina 90, 831, 845
hypsirhinoides 89
Hyssopus 393
Hystrix 519

Ianthia... ... ... 149, 300
Ibex 477
Ibidorhynchus 993
Ichneumonidæ 722
Ichnocarpus 56, 57
ichthyætus 262, 311, 990
ichthyopa 425
Icthyophis 281
icteroides 151, 754, 911
Ictinætus 308
ignavus 917
igneitincta 120
ignicauda 302
ignipectus 303
ignotum 115, 116
Ilex 143, 698
ilex 143
ilithyia 566, 645, 653
illustris... 333
imitator 284
Imma 425
immersa 179, 332
imna ... 43, 639, 648, 654, 659, 660, 665
Impatiens 324, 476, 969, 970
inara 640, 641, 652
incana 486, 492, 498
incanus... 329
inconspicua 324
indecora 460

PAGE
indica ... 61, 62, 63, 68, 70, 82, 89, 143, 160, 166, 177, 178, 269, 306, 309, 324, 325, 326, 327, 329, 340, 341, 344, 363, 365, 377, 389, 468, 473, 477, 481, 495, 569, 576, 579, 641, 642, 652, 658, 660, 680, 738, 881, 883, 885, 887, 888, 889, 890, 948, 952, 969
Indicator 144, 153
indicum ... 157, 158, 166, 172, 269, 326, 327, 328, 488, 940, 962
indicus ...57, 162, 166, 311, 312, 362, 363, 365, 367, 581, 708, 728, 735, 880, 887, 888, 905, 921, 1007
Indigofera ... 143, 171, 325, 478, 575 702, 709, 710
indoburmanicus 307, 364
indus 308, 364, 985
inepta 135
inerme 575
inermis 326, 331, 484
infectoria 330
infortunatum 592
infumatus 306, 363
ingeniosa 411, 421
inglisi 1, 2, 281, 993
innominatus 304
Inoresa 724
inornata 125
Insecta 233
insigne 77
insignis 312
insolens... ... . 108, 358
Instia 480
instructus 514
integerrima 86, 478
integrifolia 158, 330, 577
intermedia ... 126, 180, 217, 309, 310, 360, 499, 919
intermedius 117, 500, 545, 904
interstitialis 511
intricatus 124
intrudens 793, 794
intsia 319, 325
Inula 484, 950
invida 590
iuvolucrata 320, 330, 578, 645
involuta... 183

PAGE
Iphias 977
iphita ...642, 651, 865, 868, 869, 870, 873
Ipomœa... 328
iria 162
Iridostoma 425
iris 669, 671
Isari 578
Ischœmum 164, 331
ismene ...36, 440, 441, 443, 454, 456, 457, 458, 474, 566
Isora 684, 701
ispida 305, 917, 363
italica 331
Itea 948
Ixias 570
ixiocephalus 328
Ixora 326, 370
Ixulus 116, 120
Iynginæ 304
Iyngipicus 394
Iynx 304, 916

jacobinus 265
Jacquemontiana 693
Jaquemontianum 385
Jacquemontii 65, 168, 501, 943
jaculus 549, 1000
jayakari 194
jambolana 319, 326, 578
Japalura 352, 353
japonica 310, 485
japonicum 180, 492
jara 338, 344, 618, 791, 844
Jasminum ... 327, 397, 486, 575, 965
Jatropha ... 577, 693, 701, 1016
javanensis 304, 361
javanica ... 160, 161, 172, 217, 255, 256, 312, 313, 318, 331, 364, 366, 956
javanicus 209, 312, 365
javensis... ... ... 893, 894
jehana 569
jemlaicus 192, 545, 808
Jerardianus 499
jerdoni ... 115, 208, 299, 338, 339, 359
Jesous 568
johnii 1020
Jousseaumia 226, 228

PAGE
Juglandeæ 85, 497
juglandifer 349, 559, 898
juglandifolia 183
Juglans... ... ...85, 143, 497
jujuba 575, 686
Julibrissin 66
jumbah...641, 649, 654, 853, 858, 859, 860
Juncaceæ 501
juncea 580, 689, 705, 947
Juncellus 331
Juncus 501, 582
Juniperus 338, 960
Junonia 31, 36, 566, 567, 638, 642, 646, 647, 651, 668, 865, 869, 870, 871, 872, 873, 874, 876, 879
junonia 438, 446, 449, 450
Junoniæ ... 874, 875, 877, 878, 879
Junonias 642, 654
Justicia ... 158, 318, 328, 390, 489, 868, 874
Jutropha 493

Kadu 576
Kænigii 80, 477, 963
Kalanchœ 318, 325, 482
Kalicephalus 614, 617, 831, 837
Kallima ... 31, 35, 36, 636, 638, 643, 647, 653, 1015
karka 164
kashmiriensis 152, 511, 904, 914
kauriensis 111, 114, 122, 123
Kemas 810, 811
Ketupa 364
khasiana 125, 118
klugii 52, 772
Koade 580
kœnigii 324
kollari 44, 45, 48, 57
kookeriana 501
korros 345, 621, 835, 844
kumaonensis 500
kundoo 906
Kuntiganaballi 578
kurroo 487
Kydia 59, 324
Kyllingia 162

PAGE
Labiatæ ... 159, 175, 329, 390, 392, 393, 394, 395, 490, 575, 577, 580
Labidura 233
Labio 546
lablab 166
Lachesis ... 269, 284, 353, 356, 357, 757, 758, 770, 789, 843, 845, 900
lachnopous 182
lachryma 331
lachrymans 209
laciniata 328
laciniatum 181
Lactuca 327, 485
lacustris 226
lænata 884, 895
læta 570
lætatorius 729
lætifica 411, 418
lævigatus 331
lævis 73, 488, 954
Lagenaria 166
Lagerstrœmia 326, 377, 948
Laggera 484
lagopus 689, 703, 704
Lagothrix 978
laius 567
lampas 476
Lampides 21, 30, 39, 568
lanata ... 60, 328, 329, 481, 490
lanceolana 582
lanceolaria 325
lanceolarium 851
lanceolata ... 75, 371, 484, 575, 949
lanceolatum 537
lanceolatus 112, 150, 902
lancifolia 326
languinosa 76
lania 978
Laniidæ 905
Laniinæ 125
Lanius ... 125, 144, 147, 360, 528, 905
Lantana ... 318, 320, 328, 388, 389
lanuginosa 485, 486
lanuginosum 183
lappacea 160, 395
Laridæ 311, 921
Larra 510, 517
Larus ... 262, 311, 369, 546, 921
larvata 793

PAGE
lascurus 280
lasiandra 592
lasiocarpus 143, 325, 481, 719
Lasiosiphon 318, 319, 329
Lastrea 181, 182, 332
Laticilla 258
latifolia ... 75, 172, 319, 323, 324, 325, 327, 329, 484, 580, 625, 954
latifolium 330, 689
latirostris 361, 989
laudabilis ... 639, 650, 672, 675, 679
Lauraceæ 329, 580
laureola 143, 945
laurifolia 67
Lavandula 329
lawii 327
Lawsonia 326, 377
laxflorum 706
laxum 331
leæba 168
Lebbek 65, 662
lebetina 104
Lecanthus 320, 330, 497
leda 17, 36
Leea 325, 717
Leguminosæ ...60, 62, 63, 64, 65, 66, 167, 175, 325, 478, 575, 576, 577, 578, 579, 580, 581, 641, 660, 662, 667, 688, 689, 702, 703, 704, 705, 706-717, 859, 862, 947
leiosperma 326
Lemnaceæ 162, 331
lemonias 567, 642, 651, 868
Lemoniidæ 567
Lentibulariaceæ 328
leo 545, 770
leopardus 1007
lepida ...35, 464, 467, 468, 469, 470, 473, 474, 646
Lepidagathis 158, 328, 874
lepidea ... 638, 640, 650, 675, 679, 879
lepidotum 951
Leptadenia 171, 386
Leptobryum 537
leptocentrus 714
Leptochloa 164
leptoda 940
Leptodermis 371, 484
Leptorhabdos 489
Leptosia 570, 976
Leptostraca 232

PAGE
Lerwa 223, 990
leschenaultii 893, 894
Lespedeza 479, 704, 705
Lethe ... 42, 43, 438, 440, 443, 444, 445, 446, 451, 453, 455, 465
Letosha 724, 725
Lettsomia 328
Leucas 159, 329, 577
leucocephala 264, 914
leucocephalus ... 149, 293, 299, 478, 909
Leucocytozoon 225
leucogama 584
leucogenys 146, 903, 904
leucolophus 112
leucomelanurus 259
leucomyx 754
leucomystax 794
leuconota 919
leuconyx 142, 154
leucophela 284
leucophlœa 65, 568, 569
leucophylla 490
leucopsis 146, 302, 904
leucopyrus 161, 330, 959
leucordia 261
leucoryphus 308, 918
Leucostegia 179, 332
leucotis 109
leucura 258, 300
levana 766
Levierella 941
Leycesteria 382
Libani 79
Libellula 736
Libellulidæ 736
Libythea ... 21, 39, 40, 41, 42, 43
libythea 570
Libytheinæ 40, 41
lichenoides 596
lichenora 330
licnura 412, 414
Ligustrum 327, 383, 486
Liliaceæ ... 161, 331, 500, 576, 581
Lilium 500
Limacodidæ 23
limbata 394
Limenitis 848
limetta 167
Limicolæ 311
Limnæcia 410
Limnanthemum 327

PAGE
limniace ...41, 44, 45, 46, 48, 52, 566
Limonia 80, 964
Limonidromus 362
limonum 167
Linaceæ 324
Linaria... ... ... 157, 328
Lindenbergia 157
Lindleyana 139
Lineæ 686
linearis... ... ... 183, 332
lineata 325, 687
lineatus 304, 363
lineatum 903
lingensis 770
Liniacæ 476
linifolia 159
Linum 324
Lioptila 117, 144, 145, 753
Liothrix 120
Liotiidæ 229
Liotrichinæ 120
Lippia 158
Lipsotelus 596
Litsæa 76, 329, 580
littoralis 163, 658
livia 919
lividipes 233
lividus 298, 338, 355, 838, 839, 845, 899
Lobelia... ... ... 327, 577
Lobiger... 229
Lodoicea 547, 925
Lœflingiæ 966
Loganiaceæ 386, 487, 579
longana 325
longicaudata 122
longicaulis 712
longicoxis 725
longiflorus 492, 570
longifolia 78, 143, 158, 180, 183, 328, 498, 868, 869, 872, 876, 878
longifolium 74, 944
longifolius 323, 577
longifrons 546
longiflorus 678
longirostris 303, 362
Lonicera 143, 379, 380, 381, 382, 484
Lophocercus 229
Lophophanes 145, 903
Lophophorus 156, 920
Lophospizias 308

PAGE
Loranthaceæ 30, 329, 492
Loranthus 329, 492, 570, 678
Lotus 71, 170
Loxogramme 183
loxopis 425
Luarineæ 75, 76
lubentine 640
lubentina 650, 676, 677, 879
lucifera 589
Luffa 166
lugubris 124, 305, 306
lunulata 216
lunulatum 179, 332
lutea 120
luteiventris 123
luteo-album 484
luteola 914
Lycænesthes 30
Lycænida 39
Lycænidæ ... 22, 23, 24, 26, 564, 567, 568, 645
Lychnis 476
Lycides 234
Lycium 157, 374, 955, 956
Lycodon 87, 88, 90, 92, 93, 95, 96, 98, 102, 284, 297, 298, 338, 344, 351, 546, 549, 557, 618, 619, 756, 757, 770, 791, 844, 898.
Lycopersicum 157, 166
Lygodium 183
Lygosoma 96, 269, 340, 341, 344, 353, 759
lysimachioides 375
lysimon 568
Lythraceæ ... 326, 335, 377, 378, 482

Mabuia 96, 104, 622, 836
Macacus 149, 740
macclellandi ... 115, 121, 266, 281, 356, 549, 618, 842, 845
macdougalli 555
macgrigoriæ 127
Machilus 75
Machlolopus 110
Machlolophus 144
Machlolophas 989
macii 126, 153, 304, 360
macilentus 480, 718
mackinnoni 770, 805
mcmahoni 293
macrodactyla 790, 791

PAGE
Macroglossum 761
Macrolepidopteren 234
macrolepis 756
macrolopha 797, 919
macromitrium 940
macrophylla 69, 143, 324, 331, 389, 461, 483, 497, 720
Macropisthodon ... 284, 549, 615, 756
macrops 341, 546, 757, 898
Macrorhamphus 994
macrorhiza 485
macrorhynchus ...108, 144, 256, 358, 755, 902
macrostachyum 330
macrostyla 765
macroura 882, 885, 886, 889
macrourus 881, 885
macrula 418
Macrura 230
macrura 300, 361
macruröides 881, 883, 890, 891
macrurus 306, 880, 881, 918
macularis 284
maculata 1016
maculatus 302, 306, 908
maculosum 139, 140, 330
madablota 318, 324
maderaspatana 326
maderaspatensis 161
Madihagalu 576
Mæsa 70, 327
magna 303
magnirostris 146
Magnoliaceæ 323
maha 568
mahratta 644, 653
major 490
malabarica 46, 48, 126, 328, 360, 889, 890, 911
malabaricum ...61, 327, 328, 476, 575, 862
malabaricus 281, 880, 889
malabathricum ... 377, 640, 676
malacodon 183
malacoides 975
malayenses 225
malayensis 308
malcolmi 265
malcolmii 327
malacophyllus 713
Mallotus 77, 493
Malpighiaceæ 324

PAGE
malus 325
Malva 476
Malvaceæ 59, 61, 167, 323, 476, 579, 693, 700, 701, 859, 862
mandata 442, 443, 462, 471
mandelli 117
mandellii 123
Mangifera ... 68, 85, 166, 325, 680
Manikya 575
manillensis 312
manipularis 411, 419
manipurensis 1, 2, 110
Manis 254, 255, 256
Manisuris 331
manyar 301, 361
Mappia 324, 859
Mareca 313, 922
marginatus 281, 333
Margarodes 761, 762
marianne 570
marione 645
Marlea 69, 79
Marmelos 81
Marsdenia 487
marshallorum 154, 155
Martynia 1019
maruetta 284, 920
maschilis 433
mathias... 571
maura 144, 299, 361, 907
maurorum 689
maxima, 166, 880, 881, 883, 885, 886, 887, 889
maximus 889
Maxwellii 941
mays 331
Mazus 489
mechanica 427
meda 442, 443, 462
media 476
medica 167, 945
megaceros 184, 191, 208, 280
Megachile ... 131, 132, 133, 134, 135
Megalœma 154, 155, 304
Megalurus 123
megaspila 274
melamera 978
melanicterus 302, 989
Melanitis, 17, 34, 36, 438, 440, 443, 444, 445, 446, 454, 456, 457, 458, 474, 566, 878

PAGE
melaneus 338, 349, 350, 555
melanocephala 914
melanocephalus 126, 359
Melanocorypha 916
melanogaster 312, 365
melanoides 54
melanoleucas 364
melanoleucus 127
melanolophus 145, 903
melanoneura 134
melanonotus 217, 312, 366
melanope 142, 915
melanopepla, 881, 882, 883, 884, 891, 892, 893, 894, 895
melanops 127, 148, 299, 361
melanoptera 126, 360
melanoschista 148, 754
melanoschistus 308
melanostictus ... 341, 612, 614, 622, 840
melanotis 120, 364, 918
melanoxanthus 151, 754
melanoxylon 675, 682
Melastoma 377, 640, 676
Melastomaceæ... ... 326, 376, 377
melba 917
Melhania 684
Melia 82, 571
Meliaceæ 82, 83, 324, 580
Meliosma 68
melo 166, 326
melongena 157, 166, 962
Melophus 302, 989
Melothria 326
Melursus 745
membranacea 183, 332
Memecylon 326
meminna 209
meninting 305
Menispermaceæ ... 67, 323, 575
mentha 333
menzbieri 906
mephistophelica 130, 131
Meriandra 390
merinthias 426
merione... 645
Meropidæ 305, 917
Merops 305, 363, 917
Merula 144, 149, 150, 151, 300, 754, 910
mesentina 570
Mesia 120
mesoleptini 724, 725

PAGE
Mesua 580
metactenis 597
Meteoriopsis 941
Metopidius 311, 365
Metoponia 913
metriacma 583, 585
mexicana 323
Michelia 323
micrantha 328, 868, 874
microcarpa 959
microcichla 908
micrococcos 324
Microhierax 308
Micromeria 329, 393, 490
Micromys 280, 283, 284
Microperdix ... 1, 2, 3, 216, 281, 993
microphylla 381, 482, 692
microphyllus 172
Micropternus 304, 362
micropterus 306, 363
Micropterygidæ 435
Micropteryx 435
Micropus 359
Microsarcops 311
Microstylis 499
Microtus 280, 283, 284, 770
miliacea 331
miliaceum 165, 331
Millingtonia 158
milnei 1, 113
Milvus 308, 364, 918
mimetis 411, 417
Mimosa 325, 480, 716, 717
mimosoides 325
Mimusops 70, 71, 327, 576
minima... ... ... 488, 586
Minla 120
minor 162, 262, 327, 424
minos 32
minus 115
minuta 921
minutus 515
Mirafra... 530
misani 575
missionis 849
missippus 567, 635, 643, 654
mitchelli 819
mithila 644
Mitragyna 326
Mixornis 117, 359
Modecca 644

PAGE
Modesta ... 65
modus ... 627
Moduza. 31, 636, 640, 646, 648, 652, 846, 849, 850, 851, 863, 864, 879
moellendorffii ... 546
Mœsa ... 952
monetaria ... 512
molle ... 182
mollis ... 66, 182, 480, 715
Mollugo ... 326, 483, 966, 969
Mollusca ... 228
Molpastes ... 121, 146, 359, 545, 904
molurus ... 340, 610, 844, 1020
Momordica ... 166
monedula ... 257, 902
mongolica ... 912
moniliger ... 112, 369
Monoblastus ... 727
monoica ... 326
monophylla ... 168, 324
monostichum ... 941
monsoniæ ... 160
montana. 71, 73, 283, 319, 327, 329, 475, 576, 578, 946
montanus ... 301, 362, 913
monticola ... 144, 338, 343, 356, 357, 618, 621, 753, 825, 829, 842, 843, 844, 845, 911
montifringilla ... 913
Moorcroftiana ... 715
Morinda ... 79, 177
Moringa ... 84, 166
Moringeæ ... 84
Morphinæ ... 23, 40, 41, 42, 443, 464, 467, 468, 469, 647
Morpho ... 468
Mortragus ... 811
Morus ... 61, 143, 330, 495
mosaica ... 437
moschata ... 143, 166, 481
moschiferus ... 209, 770
Moschus ... 209, 770
Motacilla ... 142, 302, 915, 992, 1019
Motacillidæ ... 257, 302, 915
mucosus ... 268, 281, 294, 345, 622, 756, 759, 836, 844, 1002
mucronata ... 163
mucronatum ... 164
mucuna ... 859
mukorossi ... 83
multiceps ... 714

PAGE
multicinctus ... 621
multifaciata ... 836
multifaciatus ... 352
multiflora ... 325
multiflorum ... 396, 498
multipunctata ... 902
multisecta ... 180
mungo ... 165, 166, 280, 283, 579
Munia ... 125, 301, 361
muntjac ... 200, 209, 549, 758, 842
murakanaberu ... 580
muraria ... 904, 983, 931
murex ... 158
Murganta ... 177
muricatus ... 332
Murœna ... 281
Murraya ...80, 324, 477, 963
murayi ... 331
Mus ... 225, 283, 746, 770
Musa ... 167, 330, 547
Muscicapa ... 906
Muscicapidæ ... 127, 906
musicus ... 262, 263
Mussænda ... 640, 849, 879
Mustela ... 284
muticus ... 309
muttui ... 127
Mycalesis ... 39, 438, 439, 443, 445, 446, 448, 449, 450, 451, 460, 468
Mycerobas ... 151, 754
mycterizans ... 757, 777, 780, 781, 782, 835
Myiophoneus ... 159, 546, 904
Myriactis ... 484
Myrica ... 77, 497
Myricaria ... 945
myrrha ... 40, 41, 42, 43
Myrsinaceæ ... 70, 327
Myrsine ... 952
Myrsineæ ... 580, 952, 953
Myrtaceæ ...69, 326, 578
mysorense ... 324
mysorensis ... 580, 964
Mytragyna ... 849
myxa ... 72, 487

Nabis ... 534, 535
Nacaduba ... 568
Nag ... 497

PAGE
nahura ... 188, 208
Naia ... 338, 355, 546, 840, 841, 845, 897, 899, 1001, 1020
Naiadaceæ ... 162
Naias ... 162
nais ... 567, 640, 680, 649
nagænsis ... 123
Nagi ... 77
Nakri ... 581
nana ... 333, 946
Nannorhops ... 963
napu ... 209
napus ... 166
Nassa ... 229
Nasturtium ... 323, 475
natans ... 741
natura ... 184
Naturæ ... 741
Naucoris ... 738
Neckera ... 942
Nectariniinæ ... 302
negleata ... 479
neglectus ... 125
neglecta ... 704, 904
negundo ... 398, 490
neilgherrense ... 327
nelayingala ... 575
Nelsonia ... 869
Nemeobidæ ... 38, 39
Nemeobiinæ ... 567
Nemorhædus ... 184, 194
nemoricola ... 126, 311
Neophron ... 918
Neopithecops ... 30
Neopseustie ... 436
Nepa ... 738
nepalense ... 476, 499, 536, 940
nepalensis ... 116, 117, 152, 303, 308, 375, 475, 478, 492, 500, 702, 911, 999
Nepeta ... 329, 490
Nephelium ... 325
Nephila ... 1016
Nephrodium ... 182
Nephrolepis ... 332
Neptis 31, 43, 567, 637, 638, 640, 641, 646, 648, 649, 654, 853, 854, 856, 858, 859, 860, 861, 862, 867, 879
nergundi ... 579
neriifolia ... 160, 318, 329

PAGE
nerissa ... 570
Nerium ... 57, 384, 566, 953
nervosum ... 379
nervosus ... 387
nesiotes ... 770
Nettapus ... 263, 264, 284
Nettion ... 525, 526
Nettopus ... 217, 318
Nettium ... 313, 546, 922
Newnesia ... 229
Nia ... 549
Nicandra ... 489
Nicoria ... 284
Nicotiana ... 157, 166
nicotianæfolia ... 577
Nigella ... 575
niger ... 298, 338, 355, 549, 622, 770, 838, 839, 845
nigra ... 143, 723
nigricans ... 326, 512
nigriceps ... 116, 125
nigricollis ... 126
nigrimentum ... 113, 752
nigripalpis ... 726
nigriventer ... 266
nigromarginatus ... 338, 344, 621
nigrum ... 157, 320, 328, 961
nilagiricus ... 331
nilgiriensis ... 440, 443, 453
Niltava ... 127, 144, 148
nimmonii ... 324
Ninox ... 307
niphe ... 644
Niphobolus ... 182
niruri ... 161
nisus ... 918, 999
nitidus ... 142
nitens ... 331
niveus ... 718
nivicola ... 223, 990
nivalia ... 492, 695
nodiflora ... 158
Nœmorhedus ... 809, 810, 811, 812, 822
norvegicus ... 746
Notodela ... 300
Notonecta ... 737, 740
Notonectidæ ... 740
Notonia ... 327
notoniana ... 326, 849
nothosærua ... 160
nubiana ... 190

PAGE
nubicola 482
nucifer 578
nucifera 162, 167
Nucifraga 902
Nudaria... 437
nudiflora ... 160, 162, 172, 331, 493
Numenius 311, 920
nummularia 686, 689, 692, 703
nummularifolius 325
nummularioides 950
nutans 331, 476, 948
nux-vomica 579
Nyctaginaceæ 159, 329
Nyctagineæ 490
Nyctanthes 383
Nycticorax 218, 366
Nyctiornis 305
nympha 287, 290, 291
Nymphalidæ ... 17, 26, 38, 39, 47, 566
Nymphalinæ ... 17, 32, 35, 39, 40, 41, 42, 468, 566, 635, 645, 654
Nyroca 313

oatesi 362
obliqua 72, 501
oblonga 69, 483, 577
oblongum 477
oblongus 324
obovata 381, 579
obovatum 327
obscura 300
obsoleta... 912
obtusifolia 954
occidantale 675, 680
occidentalis 73, 715
occipitalis 109, 144, 153, 303, 358, 362, 754
ocellus 879
Ochotona 280
ochracea 304
Ochrocarpus 323
ochropus 311, 920
Ocimum 159, 392
octolineatus 1060
Octoblepharum 939
oderatissima 855
Odina 84, 478
Odonata 739

PAGE
odontoloma 332
odorata 170, 370
odoratissima 66, 75,
odoratissimus 325
odoratum 499
odorum 57, 384, 566, 953
Odynerus 136, 137, 138
œdalea 593
Œdicnemidæ 311
œnonthe 908
Œnoplia 687
Œnopopelia 265, 309
officinale 323, 397, 475
officinalis 159, 393, 490
officinarum 163, 165
Olacaceæ 324
Olacineæ 946
Olax 946
Oldenlandia 326, 967, 968
Oleaceæ ... 327, 383, 397, 486, 859, 965
oleander 57
oleioides 143
oleoides 384
oleracea 166, 169, 323, 643
oleraceus 485
Oligodon ... 338, 349, 350, 533, 549, 555, 556, 557, 559, 831, 845, 923, 1000, 1001
oligolepis 338, 339
Oligotoma 1009, 1010
oligozonatus 89, 298
Oligura 117
olivacea 318, 325
olympia 423
Onagraceæ 483
Ononis 702
Onychium 180
operandi 627
Ophioglossaceæ 183
Ophioglossum... 183
Ophiopogon 500
Ophiurus 332
opistholeuca 908
oppositifolia 329, 370, 390, 476
opulenta 513
opulifolium 491
Opuntia 948
Orchidaceæ 330
Orchideæ 498
orchioides 330

PAGE

Oreicola 144, 149, 299
Oreinus 546
Oreocincla 151, 300, 754
Oreodoxa 936, 1010
Oribatidæ 232
orientale 180, 961
orientalis ... 61, 233, 309, 327, 381, 639, 641, 672, 727
Oriolidæ 126, 906
Oriolus 126, 906
orithyia 567
orithya ... 642, 651, 869, 871, 872, 876
ornata 758, 779, 782, 899
ornaticaudis 137
ornithopoda 331
Ornithoptera 32, 33
Orobanchaceæ 158
Orobanche 158
orobanchioides 318, 328
orophias 601
Orsotriœna ... 21, 438, 442, 445, 446, 462, 468, 471, 472
Orthacris 1007
Orthanthera 386
Orthosiphon 393
Orthotomus 123, 360
Ortygornis 216
orymagdis 435
Oryza 331
Osbeckia 376, 948
Osmotreron 308, 365
Osyris 329, 959
Otocompsa 121, 359, 531
Otocorys 916
Otogyps 364
Otostegia 394
otus 917
Ougeinia 62, 479
ovalifolia 70, 329, 485
ovalis 949
ovata 159, 580
Ovis ...184, 187, 188, 208, 280, 765, 980
Owenia 227
Oxalis 324, 476
Oxyacantha 60
oxycarpa 700
oxycephalus 345
oxyphylla 477, 687
oxyphyllum 707
Oxystelma 171
padus 143

PAGE

padwal 576
pagodarum 906
Paguma 793, 794
Palæmon 231
Palæornis ... 155, 307, 364, 755, 917
palliata 595, 884, 894, 895
pallida 485
pallidus 144, 147, 393, 609
pallifasciella 420
palligosta 760
pallipes 727
Palmaceæ ... 162, 331, 576, 578, 963
Palmæ 85
palmata ... 326, 496, 644, 697, 701
Palmeæ 467
palpebrosa ... 119, 145, 753, 983, 984
paltophanes 412, 417
palumbarius 918
Palumbus 142, 795, 919
palumbus 795
palustre 973
palustris 123
Palynema 741
Pandanaceæ 162
Pandanus 162
pandava 568
Pandion 364
panduræformis 577
paniculata 324, 386, 487, 488
paniculatum 577
paniculatus 480
Panicum 163, 165, 331
panopla 411, 412
Pantholops 184, 198
Pantoporia 632, 640, 641, 646, 648, 848
Papaveraceæ 323
papaya 167, 326
Papilio 21, 32, 37, 39, 569
Papiliones 33
Papilionidæ 26, 33, 38, 39, 569
Papilioninæ 569
Papio 978
papyrifera 495
Paracaryum 338
paradiseus 132, 360
paradisi 144, 148, 907, 989
Paradoxornis 110
Paradoxornithinæ 110
paragramma 598
parallelus 340, 791
parasitica 495

PAGE
Pareba ... 21, 39, 41
Parinæ ... 109, 902
parisatis ... 669
Parkinsonia ... 63
Parnara ... 571
Parnassia ... 482
Parottia ... 693
Parridæ ... 311
Parthenos ... 653, 654
partita ... 177
Parus ... 109, 110, 144, 145, 753, 903
parva ... 142, 906, 920
parviflora ... 161, 326, 327, 328, 394, 478, 485, 496, 499, 500, 624, 964, 977
parviflorus ... 318, 329
parvifolia ... 326, 381, 477, 640, 849
parvifolius ... 493, 696, 721
parvula ... 132
pashia ... 60, 481
Paspalum ... 163, 331
Passalidæ ... 233
Passer ... 259, 301, 302, 361, 362, 913, 986, 987, 988
Passifloraceæ ... 326
Passifloræ ... 644
Pastor ... 906
Patamon ... 231
patchouli ... 577
patula ... 158
patulum ... 375, 476
paucifolia ... 575
Pauroctenus ... 726, 727
pavana ... 568
Pavetta ... 326, 177, 178
Pavo ... 216, 309
pectinata ... 228
pectoralis ... 112, 358, 362, 910, 991
peculator ... 514
Pedaliaceæ ... 158
Pedalium ... 158
pedatum ... 179
Pedicularis ... 489
pedunculata ... 230
Pelargopsis ... 305, 363
Pellorneum ... 115, 359
Penella ... 231
penelope ... 313, 922
penetrata ... 135
Peneus ... 230
penicillata ... 916

PAGE
peninsularis ... 770
pennata ... 662, 855
pennatus ... 918
pennisetum ... 163, 165, 331
pentandra ... 326, 965, 969
pentaphylla ... 169, 324, 326, 330, 963
Pentatomidæ ... 335, 336
Pentatominæ ... 177
pentax ... 283, 284
peploides ... 972
pepo ... 166
percnopterus ... 918
Perdicula ... 216
peregrinator ... 919
peregrinus ... 360
perflarus ... 770
Pericrocotus ... 125, 360, 905
Periploca ... 171, 385
Peristrophe ... 158
perius ... 637, 640, 652, 849
Pernis ... 308
perpusilla ... 326
perroteti ... 90
perseoides ... 439, 450, 451
perseus ... 438, 439, 448, 450
persica ... 143, 325, 383
persicariæfolia ... 323
Persicoptila ... 421
persicus ... 293, 687
personata ... 915, 992
peruviana ... 328, 488
Petalidium ... 387
Petrophila ... 151, 300, 910
Peucetia ... 1016
phacida ... 636
phæoceps ... 304, 311, 362
Phajus ... 499
Phalacrocorax ... 365, 312, 546, 921
Phalacrocoracidæ ... 312, 921
phalantha ... 566, 644, 650
Phalaropus ... 921
Phaseolus ... 165, 166, 325, 479, 579
Phasianidæ ... 309, 919
Phasianus ... 309, 546
phayrei ... 365
Phegopteris ... 182
phenacistis ... 584, 585
Philonotis ... 941
Philadelphus ... 376
philippinensis ... 77, 493
philippinus ... 305, 363

PAGE
philomela ... 442, 443, 459, 460, 461
phlomidis ... 159
phlomis ... 395
Phoebe ... 75
phœniceum ... 114
phœnicophainæ ... 307
Phœnicoptera ... 262
Phœnicopterus ... 525
phœnicopterus ... 308, 365
phœnicotis ... 120, 362
phœnicura ... 909
phœnicurus ... 310, 365
Phœnix ... 85, 162, 166
Phragmites ... 164
phryne ... 570
Phrynicus ... 232
Phycodes ... 423, 424
Phyllanthus 161, 330, 492, 493, 579, 696, 721
Phyllergates ... 124
phyllophora ... 396
Phylloscopus ... 142, 123, 124, 905, 991
Physalis ... 328, 488
physaloides ... 489
Physorhyncus ... 944
Pica ... 108, 526, 902
picata ... 907, 908
picatus ... 125
Picea ... 79
Picidæ ... 916
Picinæ ... 303
Picrasma ... 964
picta ... 483, 703
picticaudata ... 200, 209, 521
pictum ... 143
pictus 216, 281, 347, 546, 775, 776, 777, 779, 780, 782, 783, 784, 785, 787, 788, 789, 790, 791, 827, 828, 830, 844
Picumninæ ... 304
Picumnus ... 304
Pieridæ ... 24, 23, 26, 38, 39, 271, 976
Pierinæ ... 570
Pieris ... 21, 39, 70, 269, 976
Pilea ... 496, 497, 972
pileata ... 260, 281
pilosa ... 324, 327, 485, 724
pilosella ... 729
pilosum ... 164, 331
pilulifera ... 161, 239, 971
Pimpinella ... 326, 483

PAGE
Pimplinæ ... 722
Pinatella ... 941
Pindrow ... 79
pinnata ... 324
Pinus ... 78, 143, 498
Pipal ... 865
Piper ... 329, 695
Piperaceæ ... 329
Pithecus ... 978
Piptanthus ... 702
piscator ... 340, 540, 611, 615, 617, 756, 757, 770, 826, 832, 844, 898
Pistacia ... 86, 478
Pisum ... 166
Pitta ... 362
Pithecanthropus ... 276
Pithecolobium ... 66
Pitta ... 303, 988
Pittidæ ... 303
Pittosporaceæ ... 323
Pittosporum ... 323
placenta ... 227
placida ... 644, 650, 879
Placuna ... 227, 229
plantaginea ... 162
Plantagineæ ... 490
Plantago ... 490
Platacanthomys ... 280
Platalea ... 261
Platanaceæ ... 61
Platanus ... 61
platyceps ... 340
platyceros ... 209
Platypeplus ... 592
platyphylla ... 378, 497, 697
Platystemma ... 489
plebeja ... 329
plebejum ... 160, 329
plecenta ... 229
Plecospermum ... 697
plectranthoides ... 389
Plectranthus ... 329, 389, 392, 490
Plectronia ... 326
Pleopeltis ... 183, 332
pleschanka ... 907, 908
plexippus ... 41, 44, 45, 46, 47, 48, 49, 50, 51, 54, 566
plicata ... 703
plinius ... 568
Plocidæ ... 94

PAGE
Ploceinæ 301
Ploceella 361
Ploceus 301, 361, 627, 632
Plotus 312, 365
Pluchea ,. 949, 950
Plumatella 228
Plumbaginaceæ 327
Plumbagineæ 577, 578
Plumbago ... 327, 577, 578, 693
plumbeitarsus 124
plumbicolor 284, 546, 549, 756
Plumeria 72
Plutellidæ 423
Pnœpyga 123
Podiceps 218
Podicepes 313, 366, 995
podocarpum 706
Podoces 549
Poduridæ 739
pœcilorhyncha 217, 922
pœcilus 761
poetica 437
Pogonatum 939
Pogostemon ... 318, 329, 389, 577
Poinciana 63, 662
poli 187
Polioaëtus 364, 990
poliocephalus... ... ... 306, 310
politoria 494
polyacanthus 713, 714
polyandrum 323
polyantha 76
Polyblastus 727
Polycarpæa 169, 966
Polycarpon 966
polycarpum 708
Polychrosis 587, 588, 589
polydecta 439, 443, 448, 449, 450, 451
Polygala 169, 323, 475
Polygalaceæ 323, 475
polygama 685
polygamus 159
Polygonaceæ ... 160, 329, 491, 694, 695
Polygonium 491
polygonoides 694
Polygonum 160, 329, 694, 695
Polymitarcys 741
polymnestor 32
Polyodontophis ... 296, 340, 757, 897
Polyommatus 30, 568
polyphyllum 500

PAGE
Polyplectrum 309
Polypodieæ 182
polypodioides 181
polyspatha 501
polystachya 390, 490
polystachyum... 695
polystachyus 162
Polystichum 181
polytes... ... ... 32, 33, 569
Pomatorhinus... 115
Pongamia 63, 325, 862
pondicerianus ... 125, 216, 360
populnea 862
populifolia 685
Populus 143, 498
Porana 328, 488
Porcellis 772
porcinus 207
Porites 226
Poritidæ 226
Porocephalus 614, 617, 837
Porpax 330
porphyraceous ... 345, 549, 827, 844
Porphyrio 310
porrectus 806
Portulaca 169, 323, 643, 966
Portulacaceæ 323
porphyronotus 906
Porzana... ... ... 284, 920
poshwa 59
Potamogeton 162
Potamonidæ 231
Potentilla 481, 719
Pothus 579
Pottia 940
Pouzolzia 330, 697, 969
præceps... 590
prasinus ... 281, 345, 346, 353, 354, 825, 834, 844, 845, 899
pratense 973, 974
pratensis 330
Pratincola ... 144, 148, 299, 361, 907
Prattus 225
precatorius 578, 578
Precis 1015
Premna 158
Prenanthes 485
Presbytis 978
prestori 229
prevostii 770
Primnoidæ 227

PAGE

Primulaceæ ... 327, 486
Prinia ... 125, 360
prinoides ... 578
Prinsepia ... 480, 690
prionitis ... 158, 575
proarchos ... 347, 775, 780, 783, 784, 791, 827, 844, 898
proboscidea ... 1019
procera ... 52, 66, 171, 385, 499
procris ... 31, 636, 640, 652, 846, 850, 851, 863, 879
procumbens ... 327, 328, 874
prolifera ... 182
Propaprus ... 117
Propasser ... 912, 991
prorsa ... 766
prosarista ... 410
Proschistis ... 587, 589, 590
Prosopis ... 64
prospera ... 591
prostrata ... 161, 690, 874
protomomelæna ... 300
proxima ... 512
pruniformis ... 492, 959
Prunus ... 143, 325, 480, 690
Psammodynastes ... 353, 546, 758, 833, 845
Psammophis ... 546, 549
psaphon ... 658
psaroides ... 145, 904
pseudechis ... 211
Pseudocajan ... 709
Pseudocerastes ... 293
Pseudogyps ... 364
pseudosabina ... 960
Pseudoscolopax ... 994
Pseudoxenodon ... 341, 757, 898
Psidium ... 166
Psittacidæ ... 307, 917
Psoralea ... 703
psoralioides ... 165
Psychidæ ... 1020, 1021
psychopa ... 433
Pterideæ ... 179
Pteris ... 180, 332
Pterocercus ... 614, 617, 826, 837
Pterocles ... 216, 990
Pteroclurus ... 216, 549
Pterospermum ... 59
Pteruthius ... 120, 144, 145
pterygosperma ... 84, 166

PAGE

Pteryobryopsis ... 941
Ptyas ... 294, 1002
Ptychognathus ... 231
Ptyonoprogne ... 914
pubigera ... 390
Pucrasia ... 797, 919
puddum ... 480
pudica ... 325
Pueraria ... 479
pugnax ... 216, 365
pulchella ... 325, 710
pulcher ... 991
pulcherrima ... 63, 324, 716
pulcherrimus ... 912
pulchra ... 179
Pulex ... 234
Pulicaria ... 950
pulverulentus ... 353, 546, 758, 833, 845
pumila ... 159, 172
punctatus ... 756
punctulata ... 361
Punica ... 167, 378
puniceus ... 365
pungens ... 68, 718
punjabensis ... 83
punjaubensis ... 130, 132, 135
Pupalia ... 160, 395
purpurescens ... 380
purpurea ... 60, 325, 711
purpureus ... 688, 718, 887
pusana ... 1008
pusilla ... 123, 522, 913
pusilium ... 969
Putorius ... 280, 980
Putranjiva ... 77, 493
Pycnonotus ... 121, 359
Pycnorhampus ... 151, 754
Pycnorhamphus ... 911, 990
pycnostegia ... 329
Pycreus ... 162, 331
Pyctorhis ... 115
Python ... 340, 610, 844, 1020
pygmæus ... 162
Pygopodes ... 313
pyranthe ... 570
Pyrgomorphine ... 1007
pyriforme ... 537
pyrogastra ... 429
Pyrrhocorax ... 902
Pyrrhocoris ... 552
Pyrrhopicus ... 304

PAGE
pyrrhonotus ... 259
pyrrhotis ... 304
pyrrhotrichus ... 713
Pyrrhula ... 911, 991
pyrsonota ... 882, 884, 896
Pyrus ... 60, 67, 143, 325, 481, 482

quadriaurita ... 180, 332
quadricornis ... 196, 209
quadrifida ... 169, 966
quærula ... 772, 773
quassioides ... 964
quercifolia ... 332
Quercus ... 698, 143, 486, 492, 498
Querquedula ... 313, 922
quettæ ... 510
quincunciatus... 340, 611, 613, 757, 833, 845, 898
quinquelocularis ... 143, 381, 484

racemosa ... 60, 325, 581, 593
racemosus ... 161, 163, 318, 331, 500
radiatus ... 347, 758, 825, 844
radicans ... 180
radicosum ... 139, 141
Rahinda ... 637, 638, 640, 641, 649, 852, 854, 855, 856, 857, 858, 861
raidhaka ... 270
Rallidæ ... 310, 920
Rallus ... 284
Ramontchi ... 73
ramosissima ... 157, 324, 328
ramosum ... 333
Rana ... 790, 791
Randia ... 326, 370
ranga ... 640, 652
Ranjiki ... 578
Ranunculaceæ ... 323, 475, 575, 576
Rapala ... 30
Raphanus ... 166
rappi ... 351, 557
rariflora ... 330
rattus ... 770
Ratufa ... 880, 881, 882, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896
rectirostris ... 231
rectum ... 973

PAGE
recumbens ... 491
recurva ... 960
recurvirostris ... 311
recurvum ... 160, 395
Reduviidæ ... 28
reevesii ... 382
reflexa ... 488
refulgens ... 156, 920
regia ... 85, 143, 497, 662, 936, 1010
Regulidæ ... 905
Regulus ... 905
Reinwardtia ... 324, 476, 686
religiosa ... 57, 80, 161, 330, 495, 865
remifer ... 122
Remusatia ... 331, 501
repanda ... 159
repens ... 158, 328, 478, 490
reptata ... 122, 123
Reptonia ... 70, 953
resoluta ... 510
reticulata ... 167
reticulatum ... 183
reticulatus ... 161
retusa 73, 161, 170, 320, 323, 325, 327, 330, 480, 493, 579
revoluta ... 941
Rhacophorus ... 281
Rhadinea ... 556
Rhamnaceæ ... 324, 686, 687, 688, 862
Rhamneæ ... 477
rhamnoides ... 958
Rhamnus ... 687, 688
Rhazya ... 953
rhesus ... 150
Rhinacanthus ... 391
Rhinoceros ... 746, 770
Rhinosciurus ... 770
rhionus ... 770
Rhipidura ... 128
rhodanis ... 434
rhodochrous ... 991
Rhododendron... 70, 377, 486, 951
Rhodonessa ... 264, 546
Rhodopechys ... 912
Rhodospiza ... 912
rhombifolia ... 170, 323, 693
rhomboidea ... 324, 685
Rhopalocera ... 17, 564, 976
Rhopodytes ... 307, 364
Rhus ... 83, 84, 477, 478, 580, 947, 964
Rhyacornis ... 300, 910

PAGE
Rhyncholaba ... 760
Rhynchops ... 312
Rhynchosia ... 479, 709
Rhynchostylis ... 499
Rhynchota 234, 335, 739, 740, 772, 1008
Rhynchoten ... 234
Ribes ... 960, 961
ribes ... 327, 494, 580
richardi ... 302
Ricinus... 161, 166, 962
ridibundus ... 921
rigida ... 946
rigidula ... 479
Rinacanthus ... 328
riparia ... 914
ripponi ... 114, 118
risorius ... 919
Ritchiana ... 963
rivularis ... 475
Robertianum ... 974
robusta ... 317, 952
Rosa ... 143, 325, 481, 693, 720
rosa ... 307, 364
Rosaceæ 60, 61, 67, 325, 480, 690, 691, 692, 717, 718, 719, 720
rosaceus ... 142
Roscoea ... 499
roseus ... 525, 906
Rostratula ... 311, 365
rosulatum ... 482
rothiana ... 324, 329
Rothii ... 72
Rotifera ... 228
Rottbœllia ... 331
rottlerianus ... 172
rotundifolia ... 335, 476, 686
rotundifolium... 484
Rourea ... 667
roxburghiana ... 324
roxburghii 77, 493, 496, 499, 624, 625
Roylea ... 394, 397
Royleana ... 164, 696, 946
royleanum ... 483
royleanus ... 164
roylei ... 487, 969, 970
rubeculoides ... 127, 361
rubellum ... 500
Rubia ... 326, 484, 968
Rubiaceæ 177, 326, 370, 371, 372, 373, 484, 576, 578, 580, 849, 967, 968

PAGE
rubicaulis ... 480, 716
rubra ... 965
rubricapillus ... 117, 359
rubrum... 141, 961
Rubus 143, 325, 333, 480, 481, 718, 719
ruderalis ... 329
Ruellia ... 158
rufa ... 109, 358
ruficaudus ... 907
ruficollis ... 111, 115
rufigenis ... 118
rufilata ... 149, 300
rufinuchalis ... 903
rufiventris ... 909
rufo-barbatum... 181
rufo-bimaculatus ... 136
rufula ... 549, 914
rufulus ... 302, 362
rugosa ... 324
rugosus ... 392, 489, 490
rugulosa ... 497
Rumex ... 492
rumphii ... 330
runcinata ... 327
Rungia ... 158, 328
rupestris ... 326, 914, 919
Rupicapra ... 807
rupifera ... 602
rupii ... 549
russelli ... 338
rustica ... 302, 362, 526, 902, 914
rusticola ... 156
rusticula ... 311, 365, 921
Rutaceæ ...30, 68, 80, 81, 324, 477, 721, 945, 963, 964
ruthenicum ... 956
Ruticilla ... 300, 909, 991
Ruticillinæ ... 299
rutila ... 313, 751, 914
rutilans ... 273, 986, 987, 988

Sabiaceæ ... 68
Saccharum ... 163, 165
Saccolabium ... 141
Saccopetalum... 658
sacin ... 208
Sageretia ... 370, 688
Sagittarius ... 897
Salacia ... 578
Salda ...1008
Salesorii ... 719

PAGE
Saletara 976
Salicacæ 330
salicifolia 958
Salicineæ 498, 699, 700
Salicornia 160, 172
Salina 944
Salix 320, 330, 498, 699, 700, 959
saloma 653
Salsola 160, 957
Salvadora 383, 384
Salvadoraceæ 383, 384
Salvia ... 159, 172, 329, 394, 490
salvifolia 685
sambucina 325
Sambucus 437
Sambur 209
Samydaceæ 326, 694
sanctum 159, 392
sanguinale 163
sanguinea 378, 389, 912
sanguineus 333
sannio 112
Santalaceæ 959
santaloides 667
Santulaceæ 329
sapiens 150
sapientum 167
Sapindaceæ ... 86, 325, 477, 581, 956
Sapindus 83
Sapium 77, 493
Saponaria 323
Sapotaceæ 70, 71, 327, 576
Sarcanthus 499
Sarcidiornis 217, 312, 366
Sarcococca 492
Sarcocca 959
Sarcocephalus... 849
Sarcogrammus 311, 365
Sarcostemma 171
sarmaticus 280, 980
Sasia 304
sativa ...330, 331, 494, 500, 575, 975
sativum 161, 166
sativus 166
saturata 303
saturatus 155, 754
Satyrinæ ... 17, 22, 32, 34, 35, 36, 39, 40, 438, 443, 446, 468, 469, 472, 566, 654
Satyrium 499

PAGE
saularis 119, 300, 361
saundersi 1010
saxatilis 911
Saxicola 907, 908
Saxifraga 482
Saxifragaceæ 376, 948, 960, 961
Saxifrageæ 482
scabrida 476
scandens 491, 496, 579
scarabœoides 479
scariola 485
scariosa 325
schimperi 327
schistaceus 299, 549
schisticeps 155, 755, 917
Schiyothorax 546
Schizæaceæ 183
Schizopoda 232
Schleichera 86
schœnanthus 332
Schœniparus 117
schomburgki 203, 204
schreiberi ... 43, 639, 648, 657, 662
schwarzi 123
Scincidæ 783
scinoides 232
Scirpus 163
Scitaminaceæ 330
Scitamineæ 499
Sciurus ... 274, 770, 880, 881, 885, 886, 887, 888, 889, 890, 893, 894, 895, 896
sclerodes 432, 433
Scolopax 156, 311, 365, 921
Scops 155, 307, 364, 755, 917
scouleri... 908
scripta 494, 972
scrobiculatum 331
scrobiculatus 328
Scrophularia 489
Scrophulariaceæ 157, 328
Scrophularineæ 489
scurrula 329, 678
scutatum 762
Scutia 324
scutulata 263, 307
scutulatus 313, 546
sebifera... .. .. 76, 571
sebiferum 493
Sebsania 711
sechellarum 547, 925

PAGE
Sedum ... 482
seena ... 311, 365
scheriæ ... 303
selecta ... 511
selectus... 514, 515
selenophora ... 640, 652
Sellignea ... 183
semecarpifolia... 143
semecarpus ... 69
semi-alata ... 83
semiculta ... 604
Semilimbidium ... 939
semipalmatus ... 994
semipinnata ... 180
semireticulata... 132
semiserrata ... 952
Semnopithecus ... 274, 549
sempervirens ... 396
Sena ... 772, 773
Senecio ... 327
Senegal ... 65
sensitiva ... 581
sepecherius ... 567
sepiaria ... 683
septentrionalis ... 344, 618, 621, 844
septentrionis ... 52
sequax ... 707
sericea ... 108, 145, 479, 481, 688, 704, 720
Serpiculla ... 762
serpyllum ... 328, 393
serrata ...61, 81, 83, 145, 477, 324, 495, 570
Serratula ... 485
serratum ... 328, 391
Sesamum ... 158, 166
Sesbania ... 711
sessiliflora ... 478
Setaria ... 331
setifera... 396
setosa ... 179
setosum... 163
severtzovi ... 912
sharpei... ... 113, 114, 254, 310
shorei ... 304
Sibiinæ ... 117
sibirica ... 148, 184, 189, 208, 808, 906
siccella ... 582
Sida ... 170, 323, 476, 579, 692, 693
Sideroxylon ... 580
Siegesbeckia ... 327

PAGE
Silybura ... 756
Simarubaceæ ... 81, 964
simile ... 903
similis ... 915
simillima ... 517
simlaensis ... 129, 133
Simotes 268, 338, 348, 349, 351, 532, 555, 556, 557, 559, 758, 791, 830, 831, 845, 897, 898, 1001
simplex... ... 158, 170, 183, 489, 696
Sinapis ... 580
sindica ... 158, 172
sinensis... 115, 116, 302, 307, 362, 364, 693, 818, 820
sinicum... 318, 331
sinlumensis ... 123
sinuata ... 324
Siphia ... 127, 142, 906
Sissoo ... 62
Sitta ... 122, 146, 904
Sittidæ ... 122, 904
Siva ... 118
Skimmia ... 143, 945
Smilax ... 331, 500
Smithia... 318, 325, 581
smithii ... 302, 362
smyrnensis ... 305, 363
sociata ... 583
Solanaceæ 157, 167, 328, 488, 576, 954, 955, 956, 962
Solanum 157, 166, 172, 173, 320, 328, 488, 954, 955, 962
solaris ... 125, 605
Solidago ... 484
solitaria ... 546, 921
soma ... 759
somnifera ... 157, 576, 955
Sonchus... 485
sondaicus ... 185
sonneratti ... 216
sophera ... 568, 716
Sophora ... 715, 773
Sopubia ... 318, 328
sorbifolia ... 717
sordida ... 118, 119
sordidus... 915
sorghum ... 164, 165, 627
Soymida ... 319, 324
spadicea ... 216, 546
spartium ... 171, 386
sparverioides ... 306, 363

PAGE

spathacea 163
spathulata 325, 482
Spatula... ... ... 313, 546, 922
speciosus 125
spectabilis 159, 181
Spergula 965
Spermacoce 576, 968
sphæromimonectes 232
Sphegidæ 510
Sphenocercus 155, 308
sphenurus 155
Sphingidæ 761, 976
spicata 325, 331, 500, 862, 660, 667
spicigera 64
spiculata 411, 420
spilocephalus 307, 755
spilonotus 110, 559
Spilornis 308, 364, 755
spinarum 384
Spinifex 163
spinoides 152
spinosa 169, 170, 326, 380, 578, 683, 692, 946
spinosum 697
Spiræa 690, 691, 717
spiralis 161
spiratum 331
Spirontocaris 231
Spizæti 998
Spizixus... 121
splachnobryoides 939
Splachnobryum 940
splendens 219, 257, 522, 545
splendidus 349, 559, 791
Spodiopsar 126
Spondias 85
Spongida 226
Spongilla 225, 226, 227, 233
Sponia 576
spontaneum 163
Spooneri 624, 625
Sporæginthus 301
squamatum 112, 114
squamatus 152, 916
squamosa 167, 323, 943
squarrosa 941
squarrosus 163
Stachyrhidopsis 110, 116
Stachyrhis 116
Stachys 394, 397

PAGE

Stagmatophora 410
staminea 376, 482
stanleyanus 770
Staphidia 118
Statherotis 591
Stellaria 476
stellata ... 318, 329, 376, 704, 948
stelligera 329
stellulatum 378
stenophyllum 940
stenura 311, 365
Stephaniana 64
Stephegyne 640, 849
Sterculia 59
Sterculiaceæ 59, 684, 859
Stereophyllum 941
Sterna 311, 312, 365, 921
stewartii 375, 395, 712
stewarti 914
stictocarpum 326
stigmosus 182
Stillingia 571
stipulata 66, 325, 967
stocksiana 168
stocksii 160, 329
stolatus... 281, 294, 341, 549, 615, 618, 826, 835, 844, 897
stoliczkæ 338, 350, 351, 546
stoloniferus 162
Stomatopoda 232
Stoparola 127, 148, 361
strabo 568
stracheyi 144, 914
stramonium 489
Streblus 57
striata 310, 365
striatula 328
striatus ... 90, 102, 103, 104, 121, 297, 298
stricta 327, 483, 953, 968, 969
Striga 318, 328
Striges 307
strigosa... 328
strigosum 940
striolata 131, 514, 516
striolatus 302, 514
strophiata 127
Strix 364, 549
strobilifera 390
strobiliferus 715
Strobilanthes 143, 388, 489, 868

PAGE
Strobilanthus 328
struthersi 993
strychnos 579
Sturnia... ... . 126, 360
Sturnidæ 126, 906
sturninus 906
Sturnopastor 126, 361
Sturnus 906
Styani 111
Styraceæ 71. 327, 486
Suæda 160, 172, 957
suaveolens 318, 326, 330
suavolens 371
subamænum 182
subbuteo 142, 755, 919
subcærulatus 111
subdita 439, 451
suberosa 62, 479
subfurcatus 263
subfusca 135
subgriseus ... 349, 533, 549, 556, 557, 560, 863
subgutturosa 199, 209
sublineatus 557
sublobatus 325
subminiatus...341, 618, 770, 757, 791, 844
subochraceum... ... ... 115, 359
subocularis 775, 780, 792
subumbellata 323
subvirides 142
succedanea 84
suecica 300, 910
sulcata 970
sulcatum 940
sulphurea 116
sumatrensis 194, 823
sundara 144, 148
superba 330, 500
superciliaries 124
superciliaris 124, 126, 361
superciliosus 124
supinus 163
suratensis 150, 155, 919
surculosum 972
Surniculus 306
Sus 280
Sussaba 728
Suthora 111
sutorius 123, 360
Suya 116, 124
Swertia 327, 487

PAGE
swietenia 580
sylvaticus 280, 283, 284
sylvestre 327
sylvestris 85, 162, 166
Sylvia 144, 146, 905
Sylviidæ 123, 257, 905
Symplocos 71, 327, 486
Sympysodon 941
synarma 431
Syngramme 183
Synonymic 437
Syntactus 728
Sypheotides 217
Sypheotis 217, 261, 995
syriacus 700
Syringa 383
Syrnium 546, 917

tabacum 157, 166
Tabernæ 576, 578
Tabernæmontana 384
Tachornis 306, 363
Tachysphex ... 510, 513. 514, 515, 516
Tachytes 510, 512, 513, 514
tacyanowskii 994
tæniolata 556, 558
tæniurus 346
Tagiades 21. 39
Tajuria 569
talifuensis 110
Tamala 75
Tamarix 67
Tamarindus 63. 576, 658, 660
Tamariscineæ 67, 944, 945
Tamarisk 944
Tamarix 169, 944, 945
tancrei 770
tanki 216
taonopa 423
taprobana 645
Tarsiger 300
Tarsolepes 23
Tarucus 568
Taverniera 689, 703
tavoyense 941
taxicolor ... 195, 814. 815, 817 818, 819, 820
taxiida 818
Taxus 78. 143
tcanentii 886

PAGE
Tecoma ... 384
Tecomella ... 158
Tectona ... 328, 577
tectorius ... 162
teesa ... 549
Telchinia ... 41, 42, 566, 647, 650, 654
Temenuchus ... 906
temmincki ... 150, 260, 546, 904
Temnolopha ... 437
templetoni ... 557
tenacissima ... 487
Tenebrionides ... 233
tenella ... 331
tenellipes ... 124
tennantii ... 881, 886
tennenti ... 881, 882, 885, 886
tennentii ... 886, 889
tenue ... 326
tenuiceps ... 281, 343
tenuifolium ... 181
tenuifolius ... 160, 161
tenuis ... 55
teprobana ... 653
tephrocephala ... 124
Tephrodornis ... 125, 360
tephrogaster ... 269
tephronotus ... 905
Tephrosia ... 171, 711
Teracolus ... 270, 281
Terias ... 567, 570
Terminalia ... 74, 75, 325, 569, 579
terminalis ... 328
ternata ... 82
ternifolius ... 389
Terpsiphone ... 128, 144, 148, 361, 907, 989
terrestris ... 170
Tesia ... 117
testaceipes ... 514, 515
tetanota ... 602
Tetraceros ... 196, 209
tetragona ... 162
tetragonum ... 487
tetragyna ... 686
tetrandra ... 669
Tetraogallus ... 223, 523, 920
tetrasperma ... 320, 330, 370, 498
thais ... 644, 651
Thalictroides ... 180
Thalictrum ... 475
Thamnobia ... 783

PAGE
thar ... 823
Tharrahaleus ... 911
Thaumantis ... 469
theobaldi ... 349
theophrastus ... 568
Thereiceryx ... 304, 363
Theretra ... 760
Thesium ... 333
Thespesia ... 324, 476, 862
thespias ... 423
Theymelæaceæ ... 492
thodon ... 546
Thomsoni ... 970
thomsoniaum ... 500
thoracica ... 123
Thorax ... 590
Thriponax ... 304
Thunbergia ... 320, 328
Thunia ... 499
thura ... 912
Thyca ... 976
Thymelæaceæ ... 329, 957, 958
thymifolia ... 161, 330
Thymus ... 393
thyodamas ... 641, 649, 862
tianschanicus ... 903
tibetana ... 916
tibetanus ... 523, 814, 815, 817, 818, 819, 820
tibetica ... 394, 397, 962, 968
Tichodroma ... 904, 983, 991
tickelli ... 127
tickelliæ ... 127
Tiga ... 304
tigrinus ... 309, 365, 523
Tiliaceæ ... 324, 476, 685, 686, 859, 862
tiliæfolia ... 324
tiliæfolium ... 479, 707
Timelia ... 115, 359
Timelidæ ... 768
Timelinæ ... 115
Timia ... 234
tinctoria ... 709
Tineidæ ... 435
tindalli ... 229
tingens ... 375
Tinnunculus ... 365, 919
Tinospora ... 168, 575
tiomanensis ... 884, 893
tiphia ... 120, 359
tirucalli ... 161, 396, 959

PAGE
tissa ... 371
tomentosa ... 75, 329, 330, 325, 326, 387, 395, 491, 569, 575, 580, 684, 685, 690, 694
tomentosum ... 580, 658
Tomyris ... 1002
tonica ... 606
tonsoria ... 592
toona ... 82, 324
topela ... 301
tora ... 479, 568
Torenia ... 489
tornastis ... 586
torquilla ... 304, 916
torra ... 218
tortuosum ... 695
Totanus ... 311, 920
Trachischium ... 90, 281, 343, 549, 618, 621, 825, 829, 842, 844
Trachischiura ... 338, 342
Trachopodiopsis ... 941
Trachys ... 163
Tragia ... 320, 330, 566, 578, 645
tragocamelus ... 196
Tragopan ... 260
Tragulus ... 209, 770
Tragus ... 163
trailii ... 126
tranquebarica ... 265, 309, 365
trapeziforme ... 332
travancoricus ... 88, 756
Trema ... 494, 639, 641, 672
Treron ... 308
Trewia ... 493
triandra ... 160, 329
Tribulus ... 170
Tribura ... 123
triceps ... 162
Trichocarpus ... 711
Trichodesma ... 327
Tricholæna ... 331
Tricholepis ... 327, 962
Trichoptera ... 436, 733, 739
Trichosanthes ... 166, 326
Trichostelium ... 941
Trichostelmum ... 940
tricophylla ... 950
tridactyla ... 305, 363, 749
Tridax ... 327
trifida ... 318, 328
trifidum ... 482

PAGE
triflora ... 379, 484
trifolia ... 325, 397
Trifolium ... 478
trigona ... 327
trigonatus ... 267, 268, 352
trigyna ... 324, 476, 686
trijuga ... 86, 284
triloba ... 323
trilobatum ... 157, 173
trilobus ... 479
trinervia ... 318, 328
Tringa ... 921
triphal ... 579
tripudians ... 355, 549, 840, 845, 1001, 1020
triqueter ... 688
triquetra ... 325
triquetrum ... 325
tristis ... 126, 142, 159, 307, 347, 361, 364, 549, 757, 775, 776, 777, 780, 782, 783, 784, 785, 788, 790, 791, 792, 906, 985
tristrigatus ... 287
trita ... 702
Triticum ... 164, 165, 332
Triumfetta ... 324, 685, 686, 859
trivialis ... 142, 915
trivirgatus ... 308
Trochalopterum ... 113, 114, 752, 903
trochiloides ... 124
trochilus ... 34, 567
Trogonidæ ... 306
Tropicoperdix ... 310
Tropidonoti ... 341, 342, 614
Tropidonotus ... 281, 294, 340, 341, 549, 611, 614, 615, 617, 618, 756, 757, 770, 780, 791, 826, 832, 835, 844, 897, 898
truculenta ... 586
Tryphonidæ ... 725
Tryphoninæ ... 723
Tryphonini ... 723
tsiela ... 161
Tuberaria ... 974
tuberosa ... 169, 479
tuberosum ... 157, 166
tullia ... 467, 468, 473
Tupaia ... 280
Tupia ... 770
Turdidæ ... 907
Turdidinæ ... 300

PAGE
Turdinus ... 359
Turdus ... 911
turgidum ...163, 536, 537, 940
Turnix ... 216, 365
Turræa ... 324
Turtur ... 150, 155, 309, 365, 523, 919
Tylophora ... 55
Tylototriton ... 281
Typhlopidæ ...338, 609, 757, 897
Typhlops ... 338, 339, 609, 770, 757, 783, 805, 806, 844, 897
typhoideum ... 163, 165, 331
typica ... 89, 348, 349, 558, 756, 758, 791, 792, 830, 834, 840, 898, 1002
Typopeltis ... 233

Ulmus ... 143
umbellata ... 483, 958
umbellatum ... 326
Umbelliferæ ...326, 483, 578, 580
umbraculifera ... 284
umbrosa ... 76, 496, 972
umbrosum ... 181
undularis ... 443, 464, 465
undulata ... 158, 387, 556
unicella ... 435
unicolor 88, 89, 151, 209, 200, 253, 292, 770, 910
unicornis ... 746, 770
uniguttatus ... 234
unilaterale ... 332
Unio ... 229
univirgatus ... 266, 356
Upupa ... 306, 363, 917
Upupidæ ... 306, 917
uranias ... 422
Uraria ...479, 689, 703, 704
Urena ... 324
urens ... 331
Urocichla ... 122, 123
Urocissa ... 109, 358
Uroloncha ... 301, 361, 911
Uropeltidæ ... 756
Urotragus ... 811
ursinus ... 745
Urtica ... 496, 971
Urticaceæ 48, 57, 161, 330, 373, 494, 577, 669, 671, 697, 698, 701, 971, 972

PAGE
urticæfolia ... 157, 159
Usnea ... 319, 991
utilis ... 480, 690
Utricularia ... 318, 328

vaccaria ... 325
vaccinifolia ... 691
vaginalis ... 325, 689
vahlii ... 325, 479
valakadien ... 284
valdiviæ ... 232
Vallisneria ... 161
Vanda ... 499, 624, 625
Vanellus ... 258, 262, 522, 546, 920
Vanessa ... 22, 34, 567, 635, 638, 642, 646, 647, 651, 652, 766
Vangueria ... 326, 578
varaba ... 441, 457
Varanus ... 552, 758
varia ... 305, 331
varians ... 181, 358
variegata ... 60, 352, 353
variegatus ... 177
variolosa ... 143
vasica ...328, 391, 489, 577
velutina ... 330, 497
velutinum ... 851
veneris ... 179, 332
ventralis ... 311
venustum ... 179
venustus ...349, 556, 559, 563
veraba ... 456
verbascifolium ... 488, 955
Verbena ... 490
Verbenaceæ 158, 328, 388, 389, 391, 392, 397, 398, 490, 575, 579, 580
Vermidea ... 227
vernicosa ... 940
Vernonia ... 326, 949
Veronica ... 157
veronicæfolia ... 328
verrucosa ... 577, 957
verrucosus ... 281
versicolor ... 490, 782, 783
verticillaris ... 328
verticillata ... 159, 161, 762
verticillatum ... 484, 96

PAGE
verticulata 763
vesca 325, 481
vesta 41
vestalis 570
vestita ... 72, 183, 3254, 79, 485, 717
vexillaris 412, 418
vexillata 479
Viburnum ... 143, 146, 150, 152, 378, 379, 484, 992
vicerex 283
Vicia 479
vicinus 514
Viduinæ 301
Vigna 325, 479
vignei ... 184, 188, 208, 280
Villebrunea 698
villosa ... 59, 170, 324, 685, 711, 761
villosus 164, 168
viminalis 699
viminea 697
Vincetoxicum 385
vinifera 167, 325
Viola 475
violacea 318, 328
Violaceæ 475
violaceus 831, 845
violæ 42, 566, 650, 654
violoides 489
Vipera 338, 1004
Viperidæ ... 356, 758, 843, 900
viraja 31, 43, 641, 649
virens 304, 653
virga-aurea 484
virgata 371
virgatus 308, 688, 992
virginianum 183
virgo 741
viridana 1016
viridirostris 307
viridis 159, 305, 363
visala ... 438, 439, 448, 449
viscivorus 911
viscosa 956
viscosum 326
Viscum 329, 492
Vitaceæ 477, 717
vitalba 143
Vitex 397, 398, 490, 579
Vitis ... 167, 324, 325, 477

PAGE
vittatus 770, 905
Viverra 274
vivipara 331
voilæ 41
volubilis 53, 641
vulcanus 568
vulgare ... 164, 165, 332, 627
vulgaris ... 166, 216. 258, 262, 327, 332, 374. 522, 546, 579, 686, 691. 885, 920
Vulpes 283, 545
Vulturidæ 918

Wad 865
Wagatea 325, 660, 667, 862
wagneri... 770
walkeri 939, 940, 941
walli 268, 338
wallichi 156
wallichii ... 84, 484, 485, 497 .499
wallichiana ... 143, 389, 699, 946, 949
wallichianum 476, 500, 973
Walsura 82
wardi 208, 280
Wattii 179
Webbiana 79, 143, 720
Wendlandia 326, 640, 849
whiteheadi 284
whitei 127, 817
wightiana 323. 577, 644
wightianum 624
wightii .. 320. 326, 330, 331, 497, 940
Wikstræmia 492, 958
willeyi 614, 617, 831, 837
wingatei 118
Withania 157, 576, 955
wodier 84, 478
Wolffia 163, 331
Woodfordia 326, 377, 482
woodmasoni 555
woodrowii 329
Woodwardia 180
Wrightia 575
wynnei 283

Xanthixus 121
xanthocarpum ... 157, 172, 173
xanthogenys 141

PAGE

Xantholæma ... 305, 363, 755
xantholeuca ... 120
xanthonotus ... 144, 153
xanthorrhous ... 121
xanthoschista ... 147
xanthoxyloides ... 397
Xenodon ... 556
Xenopeltis ... 292, 294, 770
Xenorhynchus ... 312
Xiphia ... 570, 976
Xoridini ... 722
Xylia ... 859, 862
Xylophis ... 90
Xylosma ... 74, 944

yarcandensis ... 209
Ypthima ... 438, 442, 443, 445, 446, 459, 460, 461, 462, 566
yunnanensis ... 112
Yuhina ... 119

zalenta ... 589

PAGE

Zamenis ... 268, 281, 284, 294, 345, 348, 621, 622, 756, 835, 836, 844, 897
zanskarensis ... 714
Zantoxylum ... 477, 721
Zaocys ... 344, 348, 338, 621
Zaratha ... 410
Zea ... 331
Zehneria ... 483
zeylanica 320, 327, 328, 330, 577, 578, 644, 693
zeylanicum ... 954
zeylonensis ... 364
Zicrona ... 333, 335, 336
Zigophyllum ... 170
Zingiber ... 330
Zipœtis ... 43
zitenius ... 441, 458
Zizera ... 568
Zizyphus ... 524, 477, 575, 686, 687, 862
Zornia ... 325, 642
Zosterops ... 119, 145, 753, 983, 984
Zygænidæ ... 672
Zygophyllaceæ ... 972

119
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195-09

CONTENTS OF THIS NUMBER.

PAGE

On a new Species of Bush-quail (*Microperdix*) from Goalpara, Assam. By W. R. Ogilvie-Grant, with Field Notes by C. M. Inglis. (*With a Plate*) 1

The Kathiawar Lion. By Lt.-Col. L. L. Fenton 4

The Common Butterflies of the Plains of India, including those met with in the Hill Stations of the Bombay Presidency). By T. R. Bell, I.F.S. (*With Plates E & III*) 16

Plants of the Punjab. A Brief Descriptive Key to the Flora of the Punjab, North-West Frontier Province and Kashmir, Part II. By Lt.-Col. C. J. Bamber, F.L.S., I.M.S. 59

A Popular Treatise on the Common Indian Snakes. Part IX. (*With Plate IX and Diagram I.*) By Major F. Wall, I.M.S., C.M.Z.S. 87

A List of the Birds of the Bhamo District, Upper Burma. By Major H. H. Harington (92nd Punjabis) 107

On some undescribed Bees and Wasps captured by Lt.-Col. C. G. Nurse in India. By P. Cameron 129

The Orchids of the Bombay Presidency. Part VIII. (*With Plate VIII.*) By G. A. Gammie, F.L.S. 139

Bird Notes from Murree and the Galis. By Major H. A. F. Magrath 142

On the Flora of Cutch. Part II. By E. Blatter, S.J. 157

Biological Notes on Oriental Hemiptera, No. 2. (*With Plate B.*) By J. C. Kershaw and G. W. Kirkaldy 177

List of Ferns found at and around Mussoorie, 1908. By James Marten 179

Measurements of some of the Horns in the Collection of the Bombay Natural History Society. By N. B. Kinnear 184

Review ("Venoms, Venomous Animals and Antivenomous Serum Therapeutics."—By A. Calmette, M.D.) 210

Obituary.—Lt.-Col. C. T. Bingham 214

On the Existing "Close Time" for Birds and Animals in the Bombay Presidency. By J. E. C. Jukes, I.C.S. 216

Correspondence.—The Protection and Preservation of Game in India... 220

A List of the Publications relating to the Oriental Region. (From the "Zoological Record," 1906.) 225

Miscellaneous Notes—

1. Tigers and their Prey. By L. V. Bagshawe 253
2. Malayan Variety of the Sambhur (*Cervus unicolor.*) By H. S. Davies 253
3. Wild Pigs' Lairs in the Rains. By H. R. Blanford, A. C. Forests. ... 254
4. Habitat of Chinese Pangolin (*Manis aurita*). By F. E. W. Venning 254
5. The jungle Crow (*Corvus macrorhyncus*). By H. A F. Magrath, Major. 256
6. Nesting of the Long-tailed Grass-Warbler (*Laticilla burnesi*) in the Punjab. By A. J. Currie 258
7. Note on the Slaty-blue Flycatcher (*Cyornis leucomelanurus*) and the common Ruby-throat (*Calliope camtschatkensis*) in Tirhut. By Chas. M. Inglis 259

CONTENTS OF THIS NUMBER—(*contd.*).

PAGE

8. The Rufous-backed Sparrow (*Passer pyrrhonotus*) nesting in the Punjab. By A. J Currie 259
9. The Black-capped King-fisher (*Halcyon pileata*) in the Thana District. By L. H Savile 260
10. Note on the Chinese crimson-horned Pheasant (*Tragopan temmincki*). By Eugene W. Oates 260
11. Sarus Crane (*Grus antigone*) in Salsette. By Heugh S. Symons 261
12. Occurrence of the Lesser Florican or likh (*Sypheotis aurita*) in the Konkan, Western India. By Heugh S. Symons 261
13. Occurrence of the Spoonbill (*Platalea leucordia*) in Lower Burma. By J. C. Hopwood, Dy. Consr., Forests 261
14. Occurrence of the Peewit (*Vanellus vulgaris*) in Tirhut. By Chas. M. Inglis 262
15. The Lesser Flamingo (*Phœnicoptera minor*) in Cutch. By Rao Khengarji 262
16. The Whooper Swan—A Correction. By W. Osborn, Lt.-Genl., I.A. ... 262
17. The White-winged Wood Duck (*Asarcornis scutulata*) in Tennasserim. By K. Macdonald 263
18. The Cotton-Teal (*Nettapus coromandelianus*) in Sind. By R. E. Gibson, I.C.S. 263
19. The Cotton-Teal (*Nettapus coromandelianus*) in the Konkan, Western India. By Capt. B. Bacon 264
20. Occurrence of the Pink-headed Duck (*Rhodonessa caryophyllacea*) in Burma. By E. R. Jardine, Postmaster-General, Burma 264
21. The Stiff-tailed Duck (*Erismatura leucocephala*) near Nowshera. By W. P. C. Tenison, Lt., R.A. 264
22. Cruelty to Wild-fowl in the Punjab. By H. A. F. Magrath, Major ... 265
23. Local Bird migration. By A. J. Currie 265
24. A new colour variety of Macclelland's Coral Snake (*Callophis macclellandi*) and extension of the habitat of this species. By F. Wall, C.M.Z.S., Major, I.M.S. 266
25. Notes on two casualties from the Saw-scaled Viper (*Echis carinata*). By F. Wall, C.M.Z.S., Major, I.M.S. 266
26. Remarks on Snake Notes in the last Journal (No. 4, Vol. XVIII). By F. Wall, C.M.Z.S., Major, I.M.S. 267
27. A correction—The Butterflies (*Pieris brassicæ* and *canidia*). By H. D. Peile, Capt., I.M.S. 269
28. On *Teracolus* (*Colotis*) *fausta* and other species of the genus. By K. Bernhardt 270
29. Description of a new species of *Charaxes* from the Bhutan Frontier. By G. W. V. de Rhé-Philipe 270
30. Migration of Butterflies. By H. L. Andrewes 271
31. Sexual attraction in Lepidoptera. By G. P. Millett, Conservator of Forests, N. C. 272
32. Peach leaves as a substitute for Laurel leaves. By H. L. Andrewes ... 273
33. Do animals die a natural death? By G. H. Evans, Lt.-Col., F.L.S. 273
34. The fear of man in wild animals. By R. G. Burton, Major, 94th Russell's Infantry 276

PROCEEDINGS 280

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CONTENTS OF THIS NUMBER.

PAGE

A Popular Treatise on the Common Indian Snakes. Part X. (*With Plate X and Diagram I.*) By Major F. Wall, I.M.S., C.M.Z.S. ... 287

A List of the Birds of the Bhamo District, Upper Burma. Part II. By Major H. H. Harington (92nd Punjabis) ... 299

The Flora of Panchgani. By E. Blatter, S.J. ... 314

Biological Notes on Oriental Hemiptera, No. 3. (*With Plates C and I.*) By J. C. Kershaw and G. W. Kirkaldy ... 333

Notes on Snakes from the Neighbourhood of Darjeeling. (*With a Plate.*) By Major F. Wall, I.M.S., C.M.Z.S. ... 337

Some Rangoon Birds. By Major H. H. Harington (92nd Punjabis) ... 358

The Nesting of the Bar-Headed Goose (*Anser indicus*) in Tibet. (*With a Plate.*) By F. M. Bailey ... 367

Plants of the Punjab. A Brief Descriptive Key to the Flora of the Punjab, North-West Frontier Province and Kashmir, Part III. By Lt.-Col. C. J. Bamber, F.L.S., I.M.S. ... 370

Some Nature Notes. By Lt.-Col. R. G. Burton (94th Russell's Infantry) ... 399

Descriptions of Indian Micro-Lepidoptera. By E. Meyrick, B.A., F.R.S., F.Z.S. ... 410

The Common Butterflies of the Plains of India (including those met with in the Hill Stations of the Bombay Presidency). By T. R. Bell, I.F.S. (*With Plates F and I.*) ... 438

Plants gathered in and about Mussoorie during 1908. By James Marten ... 475

The Preservation of Natural History Specimens in Airtight Cases. By John Wallace, C.E. ... 502

New and Little Known Indian Hymenoptera. By Lt.-Col. C. G. Nurse ... 510

Miscellaneous Notes—

1. A Tailless Jackal. By Lt.-Col. R. M. Betham ... 518
2. A Fight between a Hyæna and a Panther. By Captain R. C. Burke. 518
3. Breeding Season of the Common Indian Porcupine (*Hystrix leucura*). By Major F. Wall, I.M.S., C.M.Z.S. ... 519
4. The Serow. By H. Shaw Dunn ... 519
5. Note on a Young Tibetan Gazelle. By F. M. Bailey (*With a photo.*) 521
6. Colour Variety of Indian House Crow. By L. C. Glascock ... 522
7. On the Occurrence of certain Birds in the Darbhanga District, Tirhut. By Chas M. Inglis ... 522
8. A Nest of *Archibuteo hemiptilopus* (Himalayan Rough-Legged Buzzard) from Tibet. By F. M. Bailey. (*With a photo.*) ... 523
9. Doves nesting on the ground. By C. W. Allan ... 523
10. Nidification of the Sarus Crane (*Grus antigone*). By Capt. E. O'Brien ... 524
11. Albino Snipe. By H. Gill ... 525
12. Flamingos in the N.-W. Frontier Province. By W. P. C. Tenison, B.A. 525

CONTENTS OF THIS NUMBER—(contd.).

PAGE

MISCELLANEOUS NOTES—concld.

13. Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in the Punjab. By Capt. J. Lindsay Smith 525

14. Occurrence of the Baikal or Clucking Teal (*Nettion formosum*) in North Behar. By G. J. Monahan, I.C.S. 526

15. Intelligence in Birds. By Major H. Delmé Radcliffe, F.Z.S., Royal Welch Fusiliers........ 526

16. On the Habits of Birds when Danger—supposed or otherwise—threatens their Nests. By Stanley Pershouse........ 528

17. The Injury Feigning Habit of Parent Birds. By Major A. Begbie ... 531

18. Extension of the Habitat of the Common Kukri Snake (*Simotes arnensis*). By Major F. Wall, I.M.S., C.M.Z.S. 532

19. Discovery of a second specimen of the Rare Snake *Oligodon elliotti*. By Major F. Wall, I.M.S., C.M.Z.S. 533

20. A Case of Hornet Poisoning. By Major F. Wall, I.M.S., C.M.Z.S. ... 533

21. The Blood-sucking Propensities of a Bug (*Nabis capsiformis*). By. N. B. Kinnear. 534

22. Notes from Mansi, Nyu Forest, Upper Burma. By D. H. M. Boyle. 535

23. *Brachymenium turgidum*, Broth, n. sp. By H. N. Dixon. 536

24. An Active Mud Volcano. By C. W. Allan. 537

REVIEW ("Birds of the Plains"—By Douglas Dewar) 538

OBITUARY.—E. H. Aitken........ 540

CORRESPONDENCE—The Operations of unscrupulous Egg Collectors 544

PROCEEDINGS OF THE BOMBAY NATURAL HISTORY SOCIETY 545

PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY........ 551

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CONTENTS OF THIS NUMBER.

PAGE

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. By Major F. Wall, I.M.S., C.M.Z.S. Part XI. (*With Plate XI and Diagram and Map.*) 555-563

THE BUTTERFLIES (*Rhopalocera*) OF THE NIMAR DISTRICT, CENTRAL PROVINCES. By D. O. Witt, I.F.S. 564-571

BIOLOGICAL NOTES ON ORIENTAL HEMIPTERA, NO. 4. By J. C. W. Kershaw and G. W. Kirkaldy. (*With Plates D and E.*) ... 571-573

THE DRUGS OF SIRSI AND KAPPAT HILLS. By L. B. Kulkarni, L. Ag. 574-581

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA. By E. Meyrick, B.A., F.R.S., F.Z.S. 582-607

NOTES ON SNAKES COLLECTED IN UPPER ASSAM. By Major F. Wall, I.M.S., C.M.Z.S. 608-623

ORCHIDS OF THE BOMBAY PRESIDENCY. By G. A. Gammie, F.L.S. Part IX. (*With Plate IX.*) 624-626

THE NESTING HABITS OF THE BAYA. By D. Dewar, F.Z.S., I.C.S. 627-634

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN HILL STATIONS OF THE BOMBAY PRESIDENCY). By T. R. Bell, I.F.S. (*With Plates D and II.*) 635-682

PLANTS OF THE PUNJAB. A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR. By Lt.-Col. C. J. Bamber, F.L.S., I.M.S. Part IV. (Continued from page 370 of this Volume) 683-721

DESCRIPTIONS OF NEW GENERA AND SPECIES OF INDIAN ICHNEUMONIDÆ. By P. Cameron 722-730

A YOUNG KYANG (*Equus hemionus*). By F. M. Bailey. (*With Plate A.*) 731

THE ADAPTATIONS OF AQUATIC INSECTS TO THEIR ENVIRONMENTS. By Gordon Dalgliesh 732-743

MISCELLANEOUS NOTES—

1. A white Tigress in Orissa 744
2. Panthers taking their "kill" up trees 744
3. The call of the Sloth Bear 745
4. Brown Rat (*Mus norvegicus*) in Khandeish 746
5. A record great Indian Rhinoceros (*Rhinoceros unicornis*) 746
6. Haunts of the Indian Rhinoceros 746
7. The measurements of some of the horns in the collection of the Bombay Natural History Society 747
8. Do wild animals die a natural death ? 748
9. The Indian three-toed Kingfisher (*Ceyx triadyactla*) at Matheran 749

CONTENTS OF THIS NUMBER—(*contd.*).

MISCELLANEOUS NOTES—*concld.*

PAGE

10. Young vulture in the sea 749
11. Common Snipe (*Gallinago cœlestis*) in Travancore in April 749
12. Pintail (*Dafila acuta*) in Baltistan in July 750
13. Duck shooting in Rajputana 750
14. The nesting of the Brahminy Duck (*Casarca rutila*) 751
15. Strange behaviour of certain birds when in possession of strong smelling insects.. 752
16. The supply of water to young birds in the nest 753
17. Bird notes from Dunga Gali 753
18. Notes on a collection of snakes from Matheran 756
19. Notes on a collection of snakes made in Baxa Dooars 757
20. A snake flirtation 758
21. Correction of Nomenclature 759
22. Some notes on the capture of Butterflies 759
23. The early stages of the Hawk Moth (*Theretra palligosta*) 760
24. New localities for rare and little known Sphingidæ 761
25. Note on the presence of the Coccid Genus *Margarodes* in India.. 761
26. Two species of "Chara" from the Bombay Island 762

REVIEWS—

"*Birds of the Plains*" and "*The Making of Species.*" By Douglas Dewar and Frank Finn. 764

"*The Birds of Burma.*" By Major H. H. Harington, F.Z.S., M.B.O.U. 767

PROCEEDINGS OF THE BOMBAY NATURAL HISTORY SOCIETY......... 769

EXTRACTS FROM THE PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY 772

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CONTENTS OF THIS NUMBER.

PAGE

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES. Part XII (*With Plate XII, Diagram and Map*); *Dendrelaphis tristis* and *pictus*. By Major F. Wall, I.M.S., C.M.Z.S. 775-792

ON A LOCAL FORM OF THE CHINESE TODDY-CAT TAKEN IN NORTH BURMA BY CAPT. A. W. KEMMIS. By R. C. Wroughton 793-794

PHEASANT SHOOTING ROUND ABOUT HILL STATIONS IN NORTHERN INDIA. By "Pine Marten" 795-804

A NEW BLIND SNAKE FROM THE WESTERN HIMALAYAS. By Major F. Wall, I.M.S., C.M.Z.S. 805-806

THE SEROWS, GORALS AND TAKINS OF BRITISH INDIA AND THE STRAITS SETTLEMENTS. By R. I. Pocock, F.L.S., F.Z.S., Supdt. of the Zoological Society's Gardens, London. Part I.--Introductory remarks upon the Structural Characters of Serows, Gorals and Takins and descriptions of the known Species of Takins (*Budorcas*) (*With 2 Plates*) 807-821

NOTE ON THE SEROW (*Nemorhædus bubalinus*) FROM THE CHUMBI VALLEY. (*With a Plate*). By Capt. F. M. Bailey 823

NOTE UPON THE SKIN AND SKULL OF A SEROW OBTAINED BY CAPT. F. BAILEY AT CHUMBI, IN TIBET. By R. I. Pocock, F.L.S., F.Z.S. 823-824

NOTES ON SNAKES COLLECTED IN UPPER ASSAM. By Major F. Wall, I.M.S., C.M.Z.S. Part II (*With a Plate*).................... 825-844

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN HILL STATIONS OF THE BOMBAY PRESIDENCY). By T. R. Bell, I.F.S. Part VII 845-879

SOME NOTES ON THE GIANT SQUIRRELS OF INDIA, BURMA AND CEYLON. By R. C. Wroughton, F.Z.S. 880-896

NOTES ON SNAKES COLLECTED IN THE JALPAIGURI DISTRICT. By Major F. Wall, I.M.S., C.M.Z.S. (*With a Map*) 897-900

NOTES ON THE BIRDS OF CHITRAL. (OCTOBER 1902 TO OCTOBER 1903). By Capt. G. A. Perreau, F.Z.S. (4th Gurkhas) 901-922

A NEW SNAKE FROM ASSAM, (*Oligodon erythrorhachis*). By Major F. Wall, I.M.S., C.M.Z.S. (*With a Plate*) 923-924

HISTORY OF THE SEA COCOA-NUT (*Lodoicea sechellarum, Labill.*) By E. Blatter, S. J. 925-937

A FIRST LIST OF MOSSES FROM WESTERN INDIA. By L. J. Sedgwick, I.C.S. 938-942

PLANTS OF THE PUNJAB. A BRIEF DESCRIPTIVE KEY TO THE FLORA OF THE PUNJAB, NORTH-WEST FRONTIER PROVINCE AND KASHMIR. By Lt.-Col. C. J. Bamber, F.L.S., I.M.S. Part V. 943-975

REVIEW.—The Rhopalocera of Java (Pieridæ). By M. C. Piepers and P. C. T. Snellen 976

CONTENTS OF THIS NUMBER.—(*concld.*).

PAGE

MISCELLANEOUS NOTES—*concld.*

25. Intelligence in Birds. By C. H. Donald, F.Z.S. 996
26. Extension of the habitat of the Sand Snake (*Eryx jaculus*). By Major F. Wall, I.M.S., C.M.Z.S. 1000
27. A second specimen of the Snake *Oligodons erythrogaster* from the Eastern Himalayas. By Major F. Wall, I.M.S., C.M.Z.S. ... 1000
28. A variety of the common Cobra (*Naia tripudians*) from Chitral. By Major F. Wall, I.M.S., C.M.Z.S. 1001
29. The Snakes of Kashmir. By Lt.-Col. L. L. Fenton 1002
30. Do wild animals die a natural death? By W. G. Betham, I.F.S. 1004
31. Entomological Notes:—
By H. Maxwell-Lefroy, M.A., F.E.S., F.Z.S.
    - (*a*) The International Congress 1005
    - (*b*) The Indian Hemopterid and its food 1005
    - (*c*) Storage of insects 1007
    - (*d*) Alcides 1007
    - (*e*) The Deccan Grasshopper 1007
    - (*f*) New Rhyncota 1008
    - (*g*) Where Cicindela breeds. 1008
    - (*h*) Attraction to light 1009
    - (*i*) The eggs of Oligotoma 1009
32. Some notes on the palm *Oreodoxa regia*. (*With a plate*). By J. P. Mullan, M.A. 1010
33. Environment *versus* Natural Selection as the cause of colouration in animals. By C. E. C. Fischer 1011
34. On the occurrence of the butterfly *Atella alcippe*, Cramer, in Travancore. By Lt.-Col. N. Manders, F.Z.S., F.E.S. 1017

EXTRACTS FROM THE PROCEEDINGS OF THE BALUCHISTAN NATURAL HISTORY SOCIETY. 1018

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